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SAFETY, SECURITY, AND STABILITY: THE ROLE OF NUCLEAR CONTROL REGIMES IN A PROLIFERATED WORLD

A Research Paper

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The views expressed in this academic research paper are those of the authors and do not reflect the official policy or position of the US Government or the Department of Defense.

PREFACE

The 103rd Congress directed professional military education schools to conduct a broad range of research related to policy issues concerning the proliferation of weapons of mass destruction. This paper comprises, in part, Air Command and Staff College's contribution to that effort.

The policy issue we chose to research concerns the development of nuclear control regimes for emerging nuclear capable countries. Our team's collective experience in nuclear weapons acquisition, operations, maintenance, communications, intelligence, and arms negotiation reveals all too clearly the perils and pitfalls associated with developing and deploying nuclear weapons. The US, in the past, has refused to provide technical assistance to enhance the safety, security, and stability of proliferating countries' nuclear arsenals—we believe this policy should change.

This research project is not without its heroes. We would like to acknowledge the unique experience and expertise our research advisor, Major Charles E. Costanzo, brought to this effort. His guidance and direction proved invaluable—without him, this paper could not have been accomplished. We would also like to thank our families who provided the moral support and encouragement to persevere.

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ABSTRACT

The Nuclear Nonproliferation Treaty cannot, in every instance, preclude proliferation by governments determined to develop nuclear weapons. The US needs a course of action that simultaneously maintains the treaty's goal of nonproliferation, yet manages and mitigates the exigencies of nuclear proliferation.

This paper explores the development of nuclear control regimes, which are the collective principles, norms, rules, and decision-making procedures that facilitate improved safety, security, and stability in emerging nuclear arsenals. The analysis begins by examining proliferators and the factors that influence their behavior. The Two-Tier Proliferation Model was developed to characterize the various factors that influence actual and potential proliferators. India, Pakistan, and Israel are used as case studies to illustrate how nuclear control regimes can be constructed from various measures and applied to proliferators to reduce the risks of accidental nuclear detonation, unauthorized use, and regional nuclear war.

Nuclear control regimes, as presented in this paper, are designed to promote nuclear safety, security, and stability in regions of proliferation concern until political circumstances are more conducive to nuclear disarmament. Ultimately, even if regional political environments do not become conducive to the elimination of nuclear weapons in some regions, nuclear control regimes could contribute immeasurably to reducing the tensions and uncertainties that often catalyze conflict into war.

SAFETY, SECURITY, AND STABILITY: THE ROLE OF NUCLEAR CONTROL REGIMES IN A PROLIFERATED WORLD

CHAPTER 1

Introduction

A Proliferated World: The Problem

In 1970, when the Nuclear Nonproliferation Treaty (NPT) entered into force, the international nuclear weapons coterie was a well-defined membership consisting of the United States, United Kingdom, France, China, and the Soviet Union. Today, Pakistan, India, Ukraine, Belarus, Kazakstan, and Israel must be added. The clear lines of bi-polar deterrence have blurred and the rules are changing. Despite the collective efforts of the many countries subscribing to the nonproliferation norm, it appears likely that more and more countries will be entering the nuclear arena. Nuclear aspirants like Iran, Iraq, and North Korea are eagerly seeking opportunities for nuclear empowerment, and they may soon attain it. Recognizing that the international community cannot, in every instance, prevent actors from gaining nuclear weapons, it is essential to investigate nuclear control regimes that will allow their arsenals to be as safe, secure, and stable as possible.

Left unchecked, countries with newly-won nuclear capability may evolve along similar lines as the United States and Russia. Nuclear weapons will first be deliverable by aircraft, surface vessels, and short range ballistic missiles, followed by medium and long-range ballistic missiles, and finally by the most elaborate of delivery systems—the

submarine launched ballistic missile. Politically irresponsible yet technically adept countries could conceivably go further and place nuclear weapons in space, which would be the nightmare of every country, superpower and non-superpower alike.

The United States, therefore, is in a unique position to offer 50 years of experience and expertise controlling nuclear weapons. No other country is as well postured to broker nuclear control regimes to enhance the safety, security, and stability of nuclear arsenals. The concern is, of course, that countries developing nuclear weapons will likely relearn the lessons of the Cold War, but they may not be so lucky. No incident has resulted in a nuclear yield nor has a nuclear weapon fallen into terrorists' hands; however, that is not to say an emerging nuclear power will achieve or be as concerned with a similar safety record. Also, in retrospect, many United States weapons development programs and policies were potentially destabilizing. Allowing emerging nuclear powers to learn as they go could have devastating consequences. These countries should be given the opportunity to learn from the mistakes made by the United States, to benefit from vast experience with safety and security systems, and to become cognizant of potential pitfalls of pursuing the potentially unstable nuclear arms practices that characterized the Cold War.

The development of a nuclear weapons capability is an evolutionary process. Figure 1 displays an eight step process that begins with the motivation to pursue nuclear weapons and ends when nuclear control regimes are actively sought to improve the safety, security, and stability of nuclear arsenals.

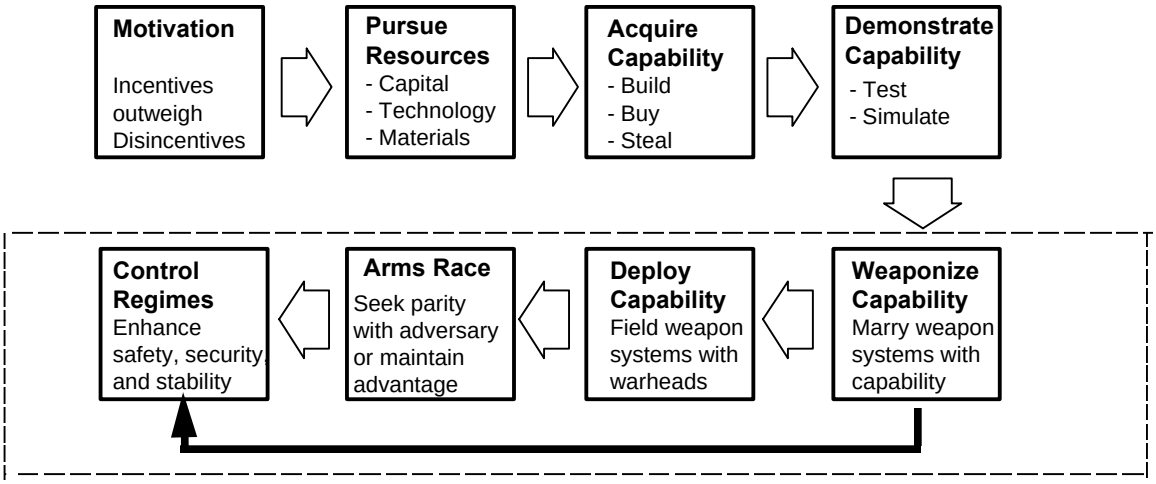

Figure 1: Evolution of Nuclear Weapons Acquisition

The focus of this paper is to develop nuclear control measures for emerging nuclear weapons states so they may avoid altogether the unsafe, unsecure, and destabilizing practices often associated with the development and deployment of a nuclear arsenal.

Key Assumptions

The following three assumptions concerning nuclear weapons in the international environment establish the basis for potential United States involvement in assisting emerging nuclear powers as they develop their arsenals.

Proliferation Will Continue. Nuclear weapons cannot be *disinvented.* They are the most powerful and destructive weapons known to man. For a variety of reasons, many states see utility in possessing nuclear weapons and will continue to seek them based upon valid security concerns, at least from their perspective.

Recent events may have actually highlighted the need for nuclear weapons. The end of the Cold War and the disintegration of the Soviet Union now allows the United

States to act more freely, unhampered by the prospect of igniting World War III. Many countries that oppose the United States previously relied on the Soviet Union as a countervailing power to American ambitions. These countries may now seek a new, independent security blanket—nuclear weapons.

Another event possibly affecting international tendencies towards nuclear proliferation was the success of coalition forces in the Desert Storm war. Here the massive fire power, precision guided weapons, and use of new technologies allowed the US-led coalition to quickly overpower a large conventional army. The demonstrated vulnerability of large forces to Western conventional weapon superiority may provide an additional incentive for nuclear weapon development. Just as NATO used nuclear weapons to hold the Warsaw Pact's overwhelming conventional forces at bay, emerging nuclear powers may also adopt a similar strategy.

Desert Storm also raised American expectations of low casualties in future wars, providing tremendous leverage to nations with nuclear arsenals. By threatening the use of nuclear weapons, these nations may effectively deter American intervention.

States Will Keep Their Nuclear Weapons. Precedence has already been established in this regard. Nothing has been done to disarm India, Pakistan, and Israel. These states have been perceived as responsible and rational; thus, there is no compelling reason to disarm them. As long as they continue to act responsibly, this will no doubt continue to be the case. Moreover, international will does not exist to violate the sovereign territory of these nations in order to remove their nuclear capability. While the United States and others may impose a variety of incentives and disincentives to dismantle nuclear weapon arsenals, possessing nuclear weapons remains a nation's sovereign right.

Nuclear Control Regimes Are Needed. International policy and strategy have focused on containing proliferation. The NPT has been successful in decreasing the potential for states to enter into a nuclear arms program. Cooperative application of political, military, economic, and informational instruments of power have reduced the motivation to pursue nuclear weapons. Likewise, restrictions on the availability of nuclear technology and materials have slowed nuclear proliferation. The message sent by the international community is clear—do not pursue nuclear weapons.

The challenge, however, is to deal with states that disregard international opinion by seeking nuclear weapons. The United States could face the dilemma of advocating nonproliferation globally while offering assistance to specific actors when they proliferate. Is this hypocrisy? Are the roles of advocating nonproliferation and assisting emerging nuclear powers compatible? While pondering these difficult questions, the United States must consider the alternatives: the possibility of emerging nuclear powers causing a catastrophic accident; or worse, the loss of a nuclear weapon to terrorists or other non-state actors. Emerging nuclear states must not be allowed to haphazardly field nuclear weapons while the international community does nothing more than condemn them for proliferating in the first place. Adoption of nuclear control regimes provides the opportunity to improve the situation dramatically.

Nuclear control regimes, as defined in this paper, are collective principles, norms, rules, and decision-making procedures that facilitate improved safety, security, and stability of nuclear arsenals. Implicit in these regimes is the view that some states will not subscribe to nonproliferation and that the US must be engaged in safety, security, and stability efforts on two levels. First, nuclear control regimes will attempt to foster an

environment that permits forces to be capable and credible enough to deter potential adversaries, but to the extent possible, preclude nuclear arms racing. Second, they will attempt to reduce the state's willingness to use their nuclear weapons, while making their arsenal as small as required to achieve their national security requirements.

Method of Analysis and Data

The analysis supporting nuclear control regimes for emerging nuclear states is presented in two steps. The first step is to categorize potential proliferators in terms of how internal and external factors influence their development and stockpiling of nuclear weapons. The Two-Tier Proliferation Model, defined in Chapter 3, was created to aid in this analysis. The second step is to identify measures to enhance the safety, security, and stability of potential proliferators' nuclear arsenals.

The Two-Tier Proliferation Model. The Two-Tier Proliferation Model categorizes countries into two groups: nuclear *haves* and *have nots*. Nuclear *haves* possess nuclear weapons and are defined by their propensity to initiate and accelerate a nuclear arms race or escalate a military conflict to include the use of nuclear weapons. This is determined by assessing at what point they are willing to use nuclear weapons and the overall capability of their nuclear arsenal. The nuclear *have nots* are assessed as not possessing nuclear weapons, but are defined by their propensity to proliferate. Their level of motivation to develop nuclear weapons and the resources at their disposal are indicative of this propensity.

The Two-Tier Proliferation Model is global in nature—all states can be characterized by the model, whether they have no nuclear aspirations whatsoever or they

are a nuclear superpower. The model reveals which states are of proliferation concern and how they compare in terms of motivation, resources, capability, and willingness to use nuclear weapons.

Identifying Nuclear Control Measures. A major effort of this paper is to identify and develop nuclear control measures to enhance the safety, security, and stability of an emerging nuclear power's arsenal. These measures are the building blocks of nuclear control regimes and are based on experiences from the Cold War. For each proliferator, the Two-Tier Proliferation Model can be applied to characterize motivation, resources, capability, and will to use. With a firm understanding of these characteristics, nuclear control measures can be selected to build regimes which meet the needs of each proliferator and account for regional security concerns. Different states require different measures; therefore, no two nuclear control regimes are identical—each must be tailored to the specific security needs and circumstances of the parties involved.

Limitations

There are certain limitations associated with this study. Only open source material was reviewed. The Two-Tier Proliferation Model does not attempt to evaluate every state currently suspected of pursuing nuclear weapons or that may have already obtained them. Three states, India, Pakistan, and Israel, were analyzed only as a means of demonstrating diverse motivations, resources, capabilities, and willingness to use nuclear arsenals. Also, this study deals only with the specific needs of each of these three proliferators. The process outlined to provide safety, security, and stability can also be applied to other proliferators and across the spectrum of states that have elected to develop nuclear

weapons. Finally, this study does not investigate the relative importance between measures within nuclear control regimes, the negotiation of these regimes, or their implementation. The regimes are examined solely on how they could improve the safety, security, and stability of the three proliferators' nuclear arsenals.

Organization

Chapter 2 presents a brief discussion of why countries pursue nuclear weapons and establishes the argument that countries will continue to proliferate despite best efforts to prevent it. The NPT is also discussed to delineate between efforts to reduce or prevent proliferation versus the effort to cope with proliferation once it has occurred. Finally, a discussion of proliferation in the world today is presented.

Chapter 3 defines the Two-Tier Proliferation Model and presents an example, North Korea, to explain the dynamics of the model and how countries are characterized.

Chapter 4 examines three countries of proliferation concern: India, Pakistan, and Israel. Their motivation, resources, capabilities, and will to use nuclear weapons are analyzed, and each country is plotted on the Two-Tier Proliferation Model. As proliferators, these three countries serve as the focus for regimes discussed later in the paper.

Chapter 5 presents a comprehensive list of nuclear control measures that could be implemented to improve the safety, security, and stability of nuclear arsenals. These measures serve as the building block for nuclear control regimes.

Chapter 6 discusses how nuclear control measures can be developed into regimes to be applied to India, Pakistan, and Israel in an attempt to reduce their nuclear capability

and limit their will to use them. This chapter also discusses why the United States should foster these regimes and how this process can apply to future emerging nuclear powers.

Key Terms

Capability. A general assessment of a country's nuclear arsenal which is defined in terms of quantity, range, and yield.

Motivation. The degree in which incentives to pursue nuclear weapons outweigh the disincentives. Countries are either motivated (incentives outweigh disincentives) or unmotivated (disincentives outweigh incentives) from seeking nuclear weapons.

Nuclear Control Measure. A specific procedure, process, or method designed to enhance the safety, security, or stability of nuclear weapons.

Nuclear Control Regime. A collection of unilateral, bilateral, and multilateral actions incorporating nuclear control measures as accepted norms of behavior.

Resources. The capital, technology, and fissile materials a country can direct towards acquiring or developing nuclear weapons.

Safety. The assurance that nuclear weapons involved in accidents or incidents will not produce a nuclear yield and the assurance that accidental or inadvertent prearming, arming, launching, firing, or releasing of nuclear weapons will not occur.[1]

Security. The assurance that deliberate prearming, arming, launching, firing, or releasing of nuclear weapons, except when directed by competent authority, will not occur and the assurance that loss or theft of nuclear weapons will not occur.[2]

Stability. The assurance that each nuclear power is generally satisfied with the level of deterrence offered by their nuclear arsenal, thereby dramatically reducing and hopefully negating the need for arms racing and preemption.

Two-Tier Proliferation Model. A tool developed by the authors to characterize a proliferator or potential proliferator by defining their level of motivation to pursue nuclear weapons, resources available to acquire them, overall capabilities of their nuclear arsenals, and will to use or employ nuclear weapons.

Will to Use. The threshold level in which a proliferator is willing to employ nuclear weapons. This can range from supporting regional hegemonic goals to a retaliatory strike when natural survival is threatened.

CHAPTER 2

A Proliferated World: The Inevitable Challenge

> In terms of human behavior, there is nothing aberrant about nuclear weapons proliferation. The motivations are as diverse as humanity itself: fear; the drive for power, influence, and prestige; and the desire to assure security and control one's destiny.[3]

Incentives to Pursue Nuclear Weapons

In the view of many states, nuclear weapons are the ultimate guarantor of a nation's security. Yet, the prevailing world view is that unlimited proliferation of nuclear weapons runs counter to all states' security interests. This chapter will briefly examine the causes for nuclear proliferation and review the international community's keystone effort to curb that proliferation, the Nuclear Nonproliferation Treaty (NPT). This chapter will also review the status of nuclear proliferation today.

Although a diverse range of incentives for nuclear proliferation are available in the literature, a taxonomy and supporting examples by Dunn and Kahn are used here because of their clarity and comprehensiveness.[4] Nations pursue the acquisition of nuclear weapons for many reasons, but these reasons can be broken down into four basic categories: national security, status or influence, bureaucratic factors, and domestic politics. It must be recognized that because no single incentive drives a nuclear weapons program, boundaries between broad categories are not distinct. For example, national security motivations have domestic political implications and vice versa.

National Security. These are the most dominant incentives because military operations against known possessors of nuclear weapons cause states to proceed

cautiously, if at all. Thus, deterrence of nuclear armed adversaries is an important incentive to possess nuclear weapons. Another security-related incentive is to use nuclear weapons as a defense against invasion. In the 1950s both Sweden and Switzerland considered whether a nuclear deterrent would enhance their posture of armed neutrality. Another incentive to possess nuclear weapons is as a weapon of last resort. Israel's nuclear arsenal is often seen as a final guarantor of national survival, to be used if hostile forces are poised to over-run their country. Another use of nuclear weapons is to intimidate non-nuclear rivals, particularly if that rival does not have security guarantees from a nuclear power. India felt China would use their newly-won nuclear arsenal in this fashion. Finally, possession of nuclear weapons may be used to improve one's bargaining position within an alliance. The French saw the development of nuclear weapons as a means to gain more influence in NATO.

Status. Status incentives do not stand alone, but normally are intermixed with security rationales. Nonetheless, in the state's internal decision making process, the achievement of international status and prestige is an important consideration. "The political value of nuclear weapons as a source of international prestige and status had been amply reconfirmed, as India could not fail to note, by reactions to the Chinese program."[5] Also, India believed an unfettered nuclear weapons development program was a key avenue to scientific and technological advancement.

Bureaucratic Factors. In addition to the incentives identified above, the French nuclear program was partially motivated by DeGaulle's efforts to strengthen the morale of the French nation after an unending series of defeats since 1940. At its inception, the newly conceived *force-de frappe* was partially intended to strengthen the morale of the

military and scientific elite and divert its attention from the Algerian situation. Scientific and technological momentum is also an incentive to pursue a nuclear weapons program. In India, for example, influential scientists played key roles in the face of weak political leadership in moving a nascent nuclear program toward a viable weapons option. In a similar vein, pressures from organized economic groups who would benefit from a nuclear weapons program could swing the final decision. "These economic groupings and their military allies can achieve sufficient organizational momentum, [and] political/economic influence in developing the character, scope, and pace of military policy and weapons development."[6]

Domestic Politics. Domestic morale and pride could be an important factor in the political decision to acquire nuclear weapons. Both the British and French nuclear programs were motivated in part by the desire to improve domestic morale and allow their nations to continue to play the part of the great powers. The Chinese nuclear program had similar goals. According to van Creveld in his book, Nuclear Proliferation and the Future of Conflict, "Building the bomb was part of a wider drive towards national independence, self assertion, and scientific progress, [these incentives] figured in a communist party bulletin on nuclear matters that was published in July 1958."[7] Finally, a nuclear program could be undertaken as part of a larger expansion of military power in an attempt to divert domestic attention from intractable internal problems.

The Nuclear Nonproliferation Treaty

First the US and then the USSR, recognized the dangers of unrestricted proliferation and initiated actions to limit access to nuclear weapons material and

expertise. The NPT, signed in 1968, had its roots in the early efforts of the United States to slow down the proliferation of nuclear weapons in the 1940s and 1950s.[8] The earliest attempt at nonproliferation was the Baruch Plan, formulated in 1946 by the United States, which failed due to Soviet resistance.

By the 1960s, other methods were examined to slow the rate of nuclear proliferation. The goals for a nonproliferation treaty were to provide a disincentive for non-nuclear states to develop nuclear weapons, to provide guidance for the global nuclear energy industry, and to slow down the arms race between the superpowers.[9] The NPT was seen as a multilateral agreement where non-nuclear weapon states (NNWS) would agree not to acquire nuclear weapons, while the nuclear weapons states (NWS) would agree not to assist in nuclear weapons development or associated technology transfer.[10] (The NWS were states that exploded a nuclear device before January 1967: US, USSR, Great Britain, France, and China).

Basic Provisions of the Nuclear Nonproliferation Treaty. The signatories to the NPT agreed that NNWS would be subject to International Atomic Energy Agency (IAEA) inspections of their nuclear programs to ensure material is not diverted from civilian to military programs. The treaty acknowledges the sovereign right of participating nations to conduct peaceful atomic research and encourages members to cooperate in civilian development of nuclear energy. Article V to the treaty requires that information obtained from peaceful atomic explosions by NWS be shared with NNWS. The NWS agreed to negotiate a cessation of the nuclear arms race and to pursue nuclear disarmament at the earliest possible date. The NPT allows for the development of bilateral and multilateral treaties establishing nuclear free zones. In order to encourage additional

states to join the treaty, the United States, Soviet Union and United Kingdom provided negative security assurances in 1978, stating they would *not* use nuclear weapons against NNWS that had acceded to the NPT.[11]

The argument most often aimed at the NPT by NNWS concerns its apparent discrimination. The existing NWS are granted a privileged position of military superiority and international prestige, while those nations that do not yet possess nuclear weapons are barred from the nuclear coterie. This argument, first articulated by the Indian ambassador to the UN in 1968, assails the NPT by acknowledging that the treaty was primarily aimed at horizontal proliferation; thus, no specific obligations were levied on NWS to limit their nuclear arsenals. In addition, the IAEA safeguards only applied to NNWS. The NWS were not required to accept any safeguards on their programs. Finally, it was argued that the real threat of nuclear proliferation came from the two superpowers, the US and USSR.[12]

Nonetheless, by 1994 over 160 nations had signed the treaty.[13] In the last twenty-five years, while the treaty has been in force, only two nations are known or believed to have conducted nuclear detonations: India (known: 1974) and South Africa/Israel (suspected: 1979). Still, states continue to find security advantages by not signing the NPT or adhering to its obligations if already a signatory. Political and military security advantages accrue from the mere ambiguity of being a nuclear weapon state. The situation suggests that in the future, suspected nuclear proliferators will not abandon these weapons programs and that new nuclear weapons states could appear. "In short, a host of political, strategic, and technological factors have placed nuclear weapons within the reach of many states."[14]

The decision to proliferate is affected by a state's view of its national security position and objectives and place in the international community. The incentives for nuclear proliferation are outside the control and often the influence of the US, particularly for those states in an adversarial relationship with the US.

Current Status of Nuclear Weapons Proliferation

The end of the Cold War has caused the major nuclear weapons states to re-evaluate their nuclear deterrence forces. The need for large standing nuclear forces is dramatically reduced by the absence of a clear, unambiguous threat. Consequently, four of the five original nuclear powers are reducing their arsenals. However, nuclear proliferation among undeclared nuclear states and other countries with incentives to seek nuclear weapons threatens to escalate dramatically, and is an increasingly important national security problem. As stated in the national security strategy of the United States; "A critical priority for the United States is to stem the proliferation of nuclear weapons and other weapons of mass destruction and their missile delivery systems."[15] This dichotomy between the actions of the world's larger and lesser powers is rooted in the spread of technology and the loosening of the restraints of a bygone bipolar world.

This section provides an overview of the current status of proliferation among state actors that are assessed to possess nuclear weapons and are not signatories of the NPT, states that are actively pursuing nuclear weapons development programs, and states that are interested in the acquisition of a nuclear weapon but do not have the technical or financial resources to develop an indigenous weapons program.

Undeclared Nuclear States. There are currently three states that are commonly believed to be undeclared nuclear weapons states. None of these states is a signatory to the NPT. A fourth, South Africa has eliminated its nuclear weapons and acceded to the NPT.

India. India is the only country apart from the original five nuclear powers to have detonated a nuclear device. Although this test was labeled a peaceful nuclear explosion by the Indians, many countries remain suspicious of India's ultimate purpose. India has the capability to produce a large supply of plutonium; thus, their nuclear program may have resulted in as many as 60 nuclear weapons.[16] India possesses aircraft and missile systems capable of delivering nuclear weapons. In May 1989, India conducted a successful test of the Agni ballistic missile which has a range capability and payload capacity sufficient to reach all targets in Pakistan and threaten some targets in China.[17]

Pakistan. Although Pakistan officially denies possession of nuclear weapons, evidence exists that they possess nuclear weapon components that can be assembled and delivered in a relatively short time. US intelligence suspected in 1993 that Pakistan had six to ten weapons.[18] US-supplied F-16's are believed to be the delivery platforms for these weapons.[19]

Israel. Most conservative estimates credit Israel with an arsenal of 50 to 100 warheads, at least some of which are thermonuclear designs.[20] Israel maintains a wide range of weaponry capable of delivering nuclear warheads, including aircraft, artillery, and ballistic missiles.

States Actively Pursuing Nuclear Weapons Programs. Several states are believed to be actively pursuing nuclear weapons programs, although these states are all signatories of the NPT.

North Korea. North Korea is currently the state of most concern regarding nuclear weapons proliferation. They have developed capabilities in the three areas required for a weapons program: trained scientists, a source and capability to produce and recover weapons-grade plutonium, and expertise in high explosive technology. Some observers allege North Korea already possesses nuclear weapons. North Korea is currently producing modified Scud-B missiles with a range of 320-340 kilometers and capable of carrying a 1000 kg warhead. They also produced the Scud Mod C with a longer range (although with a lower payload than the Scud B), and also test fired missiles (NoDong I) with a range estimated to be 1,300 km.[21] North Korea's missile development programs are financed by several potential proliferators, including Iran and Libya. In exchange, these countries may receive production models, and in Libya's case, a missile production facility.[22]

Iran. Iran is seeking to revitalize the commercial and military nuclear programs started under the Shah. In the aftermath of the 1979 revolution, several large scale reactor projects were abandoned, and the Western-trained nuclear scientists dispersed. While Western nations have refused to assist Iran in reconstituting their nuclear program, Iran is seeking technology and trained scientists from India, Pakistan, North Korea, China, and Russia.[23] Although Iran had an active missile development program, it apparently has been unsuccessful; they are currently bartering missile technology from North Korea in exchange for oil.[24]

Iraq. Iraq's nuclear weapons program was emasculated in the aftermath of Desert Storm. Yet the scale and determination of the effort led many to believe that substantial amounts of equipment have been hidden away to await the day when Iraq is no longer under the intense scrutiny of the international community. Iraq has the capability to modify Soviet-built Scud-B's to extend their range. Although Iraq was required to destroy its remaining Scuds as part of the Gulf War cease-fire terms, it is conceivable that Iraq has hidden a small quantity of these missiles.

Libya. Libya does not have the scientific or industrial infrastructure required for an indigenous nuclear weapons program. Their pursuit of nuclear weapons is believed to be the outright purchase of nuclear weapons components or an assembled weapon. They are also sponsoring development of long-range ballistic missiles in North Korea.[25]

CHAPTER 3

The Two-Tier Proliferation Model

Model Overview

The Two-Tier Proliferation Model was developed to assess each actor's level of motivation and resources to pursue nuclear weapons, or if they already have them, to assess their overall nuclear capability and will to use it. This model highlights countries of proliferation concern and examines nuclear control regimes that will enhance the safety, security, and stability of their nuclear arsenals. The model is global in nature; that is, all states can be placed on the model whether they are currently pursuing nuclear weapons, have no intention of pursuing them, or already have them. The model is broken into two tiers, one for the *have* countries and one for the *have nots*. Tier One addresses countries that have not yet gained nuclear weapons such as North Korea, while Tier Two focuses on countries that have allegedly developed nuclear weapons, such as India, Pakistan, and Israel.

Tier One—Propensity to Proliferate

The first tier concerns the nuclear *have nots*. These include all countries that may or may not be pursuing nuclear weapons, but in any case have not developed or acquired nuclear weapons. This tier captures each actor's motivation to pursue nuclear weapons and the resources they have available to buy, build, or steal them. Essentially, this tier attempts to describe an actor's intentions and resources. Some actors are highly motivated to pursue nuclear weapons, while others are neutral about acquiring nuclear

weapons or abhor them. At the same time, some countries have tremendous resources available to develop or acquire nuclear weapons, while others have virtually none. By assessing both the motivation to develop nuclear weapons and the resources to do so, a determination can be made about the actor's propensity to proliferate.

Motivation to Proliferate. Motivation can range from highly motivated, to indifferent, to unmotivated (perhaps to the point where the actor is opposed to nuclear weapons). In Chapter 2, a discussion was presented concerning the reasons countries pursue nuclear weapons, i.e., when incentives to pursue nuclear weapons outweigh the disincentives. Countries also can be opposed to seeking nuclear weapons; that is, the disincentives outweigh the incentives. Examples of disincentives include negative public opinion, no perceived threat, or unacceptable economic costs. Table 1 summarizes many of the incentives and disincentives countries face when considering to develop nuclear weapons.

Table 1: Summary of Proliferation Incentives and Disincentives

INCENTIVES	DISINCENTIVES
Deterrence of adversaries	Military reaction by other states
Defense	Absence of a perceived threat
Weapon of last resort	International norms
Coercion	Economic and political sanctions
International status/prestige	Unauthorized seizure
Assertion of autonomy and influence	Economic costs
Spillover of economics and technology	Public opinion
Domestic politics	Bureaucratic politics
Technological momentum	Potential for accidents

Source: *Nuclear Power and Nonproliferation*, Oelgeschlager, Gain, and Hain Publishers[26]

When assessing an actor's motivation to pursue nuclear weapons, the criteria listed in Table 1 paint an overall picture whether the actor is highly motivated or unmotivated.

But motivation is only one aspect considered in Tier One of the model. The other aspect is resources available to pursue nuclear weapons.

Resources to Proliferate. As illustrated in Chapter 2, several actors are highly motivated to pursue nuclear weapons, but few of them possess all of the resources needed to do so. These resources include capital, technological expertise, and the requisite fissile materials. If an actor elects to build a nuclear weapons program, vast amounts of capital and national resources are required. Reactors, reprocessing facilities, heavy water production plants, and other facilities are required for domestic fissile material production. However, with the breakup of the Soviet Union, one concern is that fissile materials and the requisite technological know-how may be available to the highest bidder. Countries that are highly motivated to pursue nuclear weapons, possess enormous amounts of capital, but lack the needed expertise and fissile materials still require considerable watching. At any rate, while many countries have the capital needed to embark on a nuclear weapons program, fewer have the needed technological know-how, and even fewer have the necessary fissile materials. With this in mind, Tier One of the Two-Tier Proliferation Model is portrayed in Figure 2. The tier is broken into four quadrants, showing the various relationships between motivation and resources a country may possess.

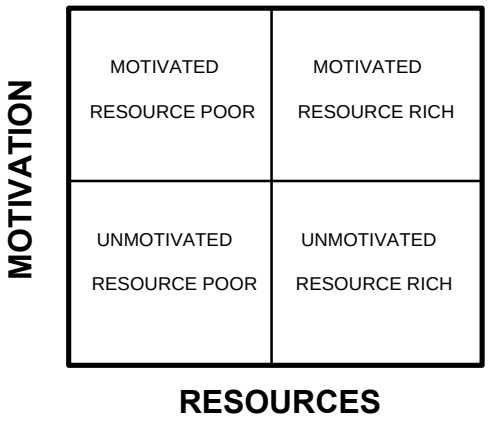

Figure 2: Tier One Description

Tier Two—Propensity to Escalate

The second tier addresses the nuclear *haves*. These countries possess nuclear weapons and the means to deliver them. Each of these countries was at one time in Tier One, but with sufficient motivation and resources they became members of the nuclear weapons coterie and now belong in Tier Two. Tier Two of the model is useful in capturing two characteristics of the nuclear *haves*. First, it describes the general capability of the proliferator's nuclear arsenal. Second, it assesses the proliferator's overall willingness to use that arsenal. An actor with a few weapons, but with considerable restraint to use them, is much more desirable than an actor with many weapons and an irresponsible willingness to use them. Tier Two of the model allows a comparison of the actors with respect to their arsenal's relative capability and their willingness to use nuclear weapons. This in turn describes each actor's potential to escalate. That is, to pursue greater capabilities, counter an adversary's systems, and to become more willing to use their arsenals. In other words, the propensity to enter into an arms race much like the United States and the Soviet Union, but perhaps on a smaller scale.

Will to Use. The model defines *will to use* as the point when an actor is first willing to employ nuclear weapons. Each responsible actor possesses a certain level of restraint. But the level of restraint will vary between actors, and it could even vary with each individual country depending on the personality of the current head of state. Will to use may also vary depending on the adversary. Thus, the employment of nuclear weapons is scenario dependent. Table 2 describes a range from irresponsible to responsible in which actors may first be willing to use nuclear weapons.

Table 2: Will to Use Nuclear Weapons

EVENT	WILL
Revenge for past or current events	Irresponsible
Regional or global hegemonic goals	Irresponsible
Preemptive strike when security interests threatened	Moderate
Retaliatory strike when security interests threatened	Moderate
Preemptive strike when national survival at risk	Responsible
Retaliatory strike when national survival at risk	Responsible

Obviously, the more responsible, the better. In the case of the United States, recent progress with Russia concerning arms reduction initiatives and a general reduction in Cold War tensions have served to push the US lower on the list, perhaps to the point where it is only willing to use nuclear weapons to retaliate against a massive strike against US sovereign territory or that of its allies. This would be the ideal situation for emerging nuclear powers as well—to use nuclear weapons only in response to a massive attack which threatens their national survival. As long as national survival is not threatened, there should never be an occasion to use nuclear weapons.

Nuclear Capability. According to deterrence theory, three conditions must exist for nuclear deterrence to work. The first condition requires the state to have a credible

nuclear capability. This capability must be sufficient enough to levy unacceptable damage upon the adversary. The second condition requires the nuclear capable state to have the will to employ nuclear weapons. The third condition requires the adversary to perceive and acknowledge the previous two conditions. If the adversary does not believe nuclear weapons will be used or if it believes it can endure the level of damage inflicted upon him, deterrence does not exist. The Two-Tier Proliferation Model plots the first two conditions for each actor. The third condition, adversary perception, is not a descriptor of the proliferator and is not included in the Two-Tier Proliferation Model.

As previously stated, each nuclear state's willingness to use nuclear weapons can span from responsible to irresponsible. Nuclear capability also varies widely. At one end of the spectrum lies nuclear-capable states like the United States and Russia, which possess vast numbers of nuclear weapons and a multitude of delivery systems. Weapons can be delivered regionally or globally, and they are designed to hold each other's nuclear weapons at risk. China, on the other hand, has a much smaller nuclear arsenal, but few would argue their ability to levy unacceptable damage on potential adversaries, thereby providing credible deterrence. Nuclear capability, as defined here, is somewhat subjective in nature, but it is useful in comparing one state to another and identifying which countries are of greater concern for escalation than others. Measures of merit for comparing nuclear arsenals between actors include total megatonage, numbers of weapons, and range of weapons. In this sense, a limited capability would be defined as an actor possessing few weapons, low yields, and regional range. An extensive, fully mature nuclear capability, on the other hand, would involve hundreds or thousands of weapons with thermonuclear yields many times more lethal than the atomic bombs dropped on Hiroshima and Nagasaki,

and delivery systems capable of striking regionally and globally within a matter of minutes. Tier Two of the Two-Tier Proliferation model is reflected in Figure 3; it draws relationships between each actor's will to use nuclear weapons and the relative capability of their nuclear arsenals.

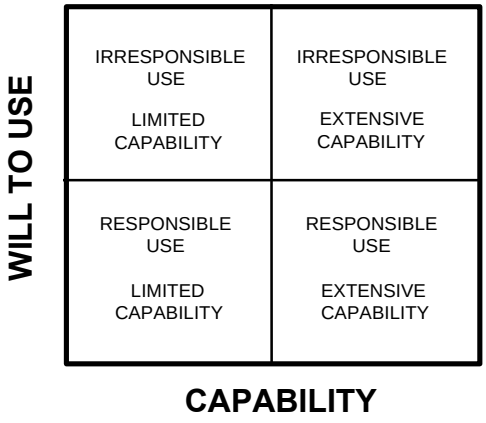

Figure 3: Tier Two Description

Identifying Actors for Nuclear Control Regimes

Applying the Two-Tier Proliferation Model is useful in identifying where actors reside relative to their motivation and resources to pursue nuclear weapons capability, or if they have already possess nuclear weapons, the threshold willingness to use nuclear weapons and the relative strength of their nuclear arsenals. Figure 4 shows the model in its entirety and delineates the worlds of the nuclear *haves* and the nuclear *have nots*.

For the nuclear *have nots*, the concern is to prevent them from gaining nuclear capability. This occurs in two ways. The first is to reduce or remove the motivation to pursue nuclear weapons. The second is to limit the availability of the resources needed to develop nuclear weapons. Many initiatives are currently employed in the international

arena to keep as many actors as possible in the area of least proliferation concern in Tier One. Initiatives such as the NPT, export restrictions and controls on critical materials and technologies, economic sanctions, and a host of other *carrots and sticks* have been largely successful in minimizing the number of actors residing in the area of greatest proliferation concern (i.e., states actively pursuing nuclear weapons).

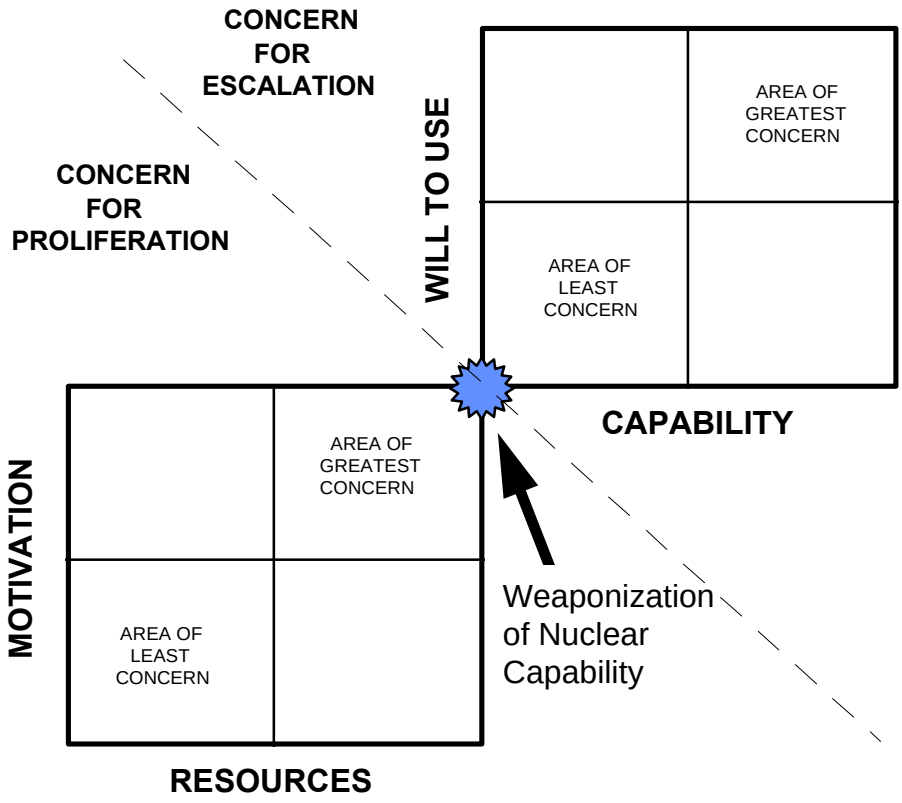

Figure 4: Two-Tier Proliferation Model

The focus of this paper, however, is Tier Two. Just as Tier One has an area of least concern, which is minimal motivation and limited resources, so does Tier Two. By employing nuclear control regimes as early as possible in the evolutionary process of acquiring nuclear weapons, the hope is to foster a responsible will to use nuclear weapons along with a limited nuclear capability. In other words, the cumulative effect of these

control regimes is to provide the safest, securest, and most stable international nuclear environment as possible.

North Korea is presented as a boundary case for the Two-Tier Proliferation Model and explains how a state can migrate through the model. This serves only as an example of how the model works. It is beyond the scope of this paper to analyze all potential proliferators; however, the three states generally believed to have proliferated (India, Pakistan, and Israel) are evaluated by the model and serve as examples of how nuclear control regimes can serve to reduce a state's nuclear capability and their will to use it.

A Boundary Case for the Two-Tier Proliferation Model

North Korea's nuclear program is currently the subject of intense interest to the international community. Figure 5 is an illustration of the life span of North Korea's nuclear program plotted on the Two-Tier Proliferation Model. This progression shows resource development, both human and infrastructure, and the internal and external factors that influenced North Korea's motivation to acquire nuclear weapons. While it is possible to disagree about the exact location of each data point, the intent is to show the influences and events that shaped Pyongyang's journey from a resource-poor and unmotivated state to a motivated and nuclear weapons production capable country. Discussed below are the circumstances and events surrounding the decision to locate the data point on the Two-Tier Proliferation Model for each period in North Korea's process to acquire nuclear weapons.

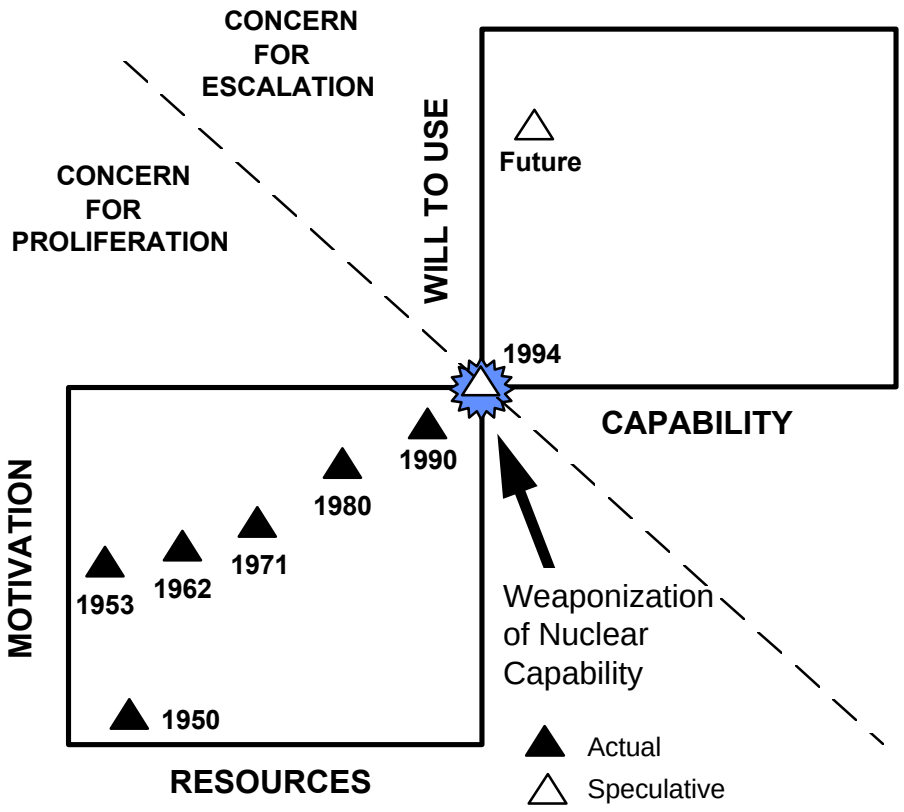

Figure 5: North Korean Proliferation Life Span

1945-1950: During this period, North Korea can be characterized as a resource poor, unmotivated country with respect to nuclear weapons. Nuclear weapons were strictly the province of the most technically advanced nations (the US and USSR) and were completely out of reach for North Korea. North Korea is placed in the lower left quadrant of Tier One, resource poor and not motivated to develop nuclear weapons.

1950-1953: The Korean War resulted in the North Koreans becoming even more resource poor as their industrial and transportation infrastructures were decimated. However, the US provided a substantial impetus for North Korea to pursue nuclear weapons due to the US threatened use of nuclear weapons to force an armistice on the

Chinese and the North Koreans. As a result, North Korea moved up significantly on the motivation axis and to the left on the resource axis.

1954-1962: During this period, North Korea focused on rebuilding its national economy from the devastation of war. North Korea made its initial entry into nuclear research via an agreement on joint nuclear research with the Soviet Union and an agreement to acquire a small research reactor.[27] Although mutual defense treaties were concluded with the USSR and China, the Cuban Missile Crisis demonstrated, in North Korea's assessment, that the USSR could not effectively withstand US pressure on the nuclear issue.[28] This, along with the emergence of the *chuche* ideology which emphasized "an independent foreign policy, a self sufficient economy, and a self-reliant defense posture," further motivated North Korea to pursue a long-term research program with the potential of developing a nuclear weapon.[29] Motivation increased slightly and resources, with the help of the USSR, returned North Korea to pre-war levels.

1963-1971: This period saw North Korea acquire national nuclear facilities with the commissioning of a small research reactor from the Soviet Union.[30] North Korea's indigenous nuclear research capabilities were substantially advanced, although remaining resource poor in terms of what was required to develop nuclear weapons. Motivation to pursue nuclear weapons increased in response to South Korea's apparent intent to establish a nuclear weapons program.[31]

1972-1980: North Korea's nuclear program broadened in scope to include an experimental plutonium reprocessing plant and construction of large scale nuclear facilities.[32] Although the two Koreas initiated reunification talks, these eventually failed. The high water mark of the North's economy was 1976, the last year its per capita income

matched or exceeded the South's.[33] Initiation of construction of the reprocessing plant and reactor complex allowed North Korea to become relatively resource rich to pursue nuclear weapons.

1981-1990: This period witnessed the development of the necessary facilities to produce and to enrich uranium in large quantities needed for a nuclear weapons program. Although North Korea signed the NPT under pressure from Moscow, North Korea did not implement safeguards or allow any IAEA inspections.[34] The Eastern Bloc crumbled and the USSR established full diplomatic relations with South Korea, events that exacerbated North Korea's sense of diplomatic isolation. North Korea also began developing and fielding ballistic missiles that could be mated with nuclear weapons.[35] Motivation and resources were considerable, placing North Korea in the upper right corner of Tier One.

1991-1994: During this period, significant events occurred which impacted the North's motivation to pursue nuclear weapons. Although North Korea signed and ratified the IAEA Safeguards Inspection Agreement of the NPT, North Korea limited inspections to less than all the facilities that should have been included. When the international community threatened sanctions to force inspections, North Korea threatened to "plunge the peninsula into the holocaust of war."[36] North Korea's economy continued to crumble and its sense of international isolation deepened with the fall of the Warsaw Pact. In the nuclear arena, some have speculated that North Korea crossed the line between likely and probable proliferators.[37] Observations of high explosive tests of the nature required for nuclear weapons were made.[38] This resulted in the assessments by many experts,

including the Central Intelligence Agency, that North Korea has become an undeclared nuclear weapons state, although with limited capability.[39]

Future: In October 1994, the US and North Korea signed a framework agreement to "achieve peace and security on a nuclear-free Korean peninsula." However, the North Korean weapons program has had a commanding share of the nation's resources for a long time, and *chuche* would make it seem unlikely that North Korea will halt their program on the verge of achieving nuclear weapons status.[40] "In fact, North Koreans believe it morally unjust for any superpower to deny small countries the right to develop their own defense capability."[41] *Chuche* requires self-reliance, especially in matters of defense. For this reason the North has consistently walked the fine line between aid from its larger allies, and dependence on them. "North Koreans feel that their self-defense objective will be permanently achieved when nuclear bombs are stored on their own soil to deter any potential aggressor."[42] The proliferation path outlined on the Two-Tier Proliferation Model may eventually see the North Koreans moving into the area of greatest concern, a substantial nuclear force with an irresponsible will to use it.

CHAPTER 4

Country Analysis

Applying the Model to Proliferators

India, Pakistan, and Israel, the three countries generally believed to possess nuclear weapons, are analyzed using the Two-Tier Proliferation Model. As proliferators, these countries reside in Tier Two where *capability* and *will to use* are of primary concern. The following analysis characterizes both of these for each country. Although India, Pakistan, and Israel have proliferated and are no longer in Tier One, *motivation* and *resources* are also assessed to provide perspective and background concerning the decision to develop nuclear weapons and the resources available to pursue them. Understanding these countries and their original motivation and resources, along with their current nuclear weapons capability and will to use it, provide a foundation to prescribe and negotiate nuclear control regimes.

In Chapter 3, North Korea was used as an example to explain the Two-Tier Proliferation Model. As presented, North Korea was plotted on the model at various dates over the past 50 years. This allowed the dynamics of the model to be displayed and demonstrates how Tier One and Tier Two fit in the model as a whole. Here, India, Pakistan, and Israel will be analyzed in much greater detail, but only their current location will be plotted on the model. There is no attempt to review their life span acquiring nuclear weapons on the model as was done with North Korea. Although it would be interesting to do so, the primary focus of this paper is to develop nuclear control regimes which will enhance the safety, security, and stability of a proliferator's nuclear arsenals.

Understanding where these countries currently reside in the model will provide the foundation needed to develop nuclear control regimes. The overall goal of these regimes is to reduce each country's nuclear capability and the will to use it.

India: Two Adversaries Too Many

India has not one, but two potential adversaries who possess nuclear weapons. From India's perspective, there is tremendous pressure to keep and further develop its nuclear capability. The following analysis will describe India's location on the Two-Tier Proliferation Model, which is currently assessed to be in Tier Two, with fairly limited capability and moderate willingness to use it. India will be examined in the context of the Two-Tier Proliferation Model by framing the discussion in terms of motivation, resources, capability, and will to use.

Motivation. It is fair to say that India's incentives for pursuit of nuclear weapons have long historical roots, and history provides the contextual bedrock for understanding them. The end of World War II brought an end to British dominance on the Indian subcontinent. Hindu-Muslim animosity led to brutal fighting in India, and in August 1947, largely Hindu India and largely Muslim Pakistan emerged. Indian-Pakistan relations did not improve with the division; each sees the other as a challenge to its very existence.[43] Pakistan doubts that India accepts it as a separate nation, while Pakistan's determination to become a home for the subcontinent's Muslims represents a challenge to India, "threatening her with dismemberment."[44]

The Pakistanis brought their fears to bear against India in 1965. Kashmir, a source of bloody conflict for years, became an open conflict. Pakistan initiated a series of border

incidents in the Ran of Kush in the spring of 1965. War followed that summer, with Pakistan launching an attack with the aim of occupying Kashmir. Pakistan was successful at first, but an Indian counterattack dashed Pakistani goals. Ultimately, the Tashkent agreement was signed, reinstating the status quo ante bellum.

Continuing friction between India and Pakistan flared again in the Indo-Pakistani war that began in March of 1971.[45] The Bengalis in East Pakistan rebelled and proclaimed an independent state, Bangladesh. A difficult and often brutal civil war ensued between West and East Pakistan (separated by 1,000 miles of Indian territory) as the Pakistani army struggled to quell the uprising. India aided the rebels, launching an all-out offensive in November 1971.[46] The United States, acting as a countervailing power to what it felt was Soviet support of India, tilted toward Pakistan. Mrs. Ghandi's forces were occupying several thousand square miles of West Pakistani territory, President Nixon sent the aircraft carrier *Enterprise* into the Bay of Bengal.[47] On December 16, India agreed to halt the war—Bangladesh was formed.

India's concerns with Pakistan has at times been matched or exceeded by its concern for China. A Sino-Indian war in October-December 1962 led to a catastrophic defeat at the hands of the Peoples Liberation Army along the Himalayan frontier.[48] A successful Chinese test of a nuclear device conducted in 1964 further exacerbated relations. Although a rapprochement has led to improved relations that allowed China's Prime Minister to visit New Delhi in December 1991, China still has one of the largest nuclear arsenals in the world.[49]

Running parallel to and inseparable from India's history of conflict is the history of its nuclear program. In the late 1940s, then Prime Minister Jawaharlal Nehru established

the Indian Atomic Energy Committee.[50] He was its leader; his Cambridge trained under-study, Homi Bhaba, was in charge. They developed a program touted as peaceful with no military aspirations. While India provided its own supplies of minerals, India received *aid and support* with facilities and equipment from three world nuclear exporters—Canada, the United States, and France.[51] The Chinese nuclear test in 1964 led to strong calls within India for a stronger nuclear program. A Chinese ultimatum during the 1965 war with Pakistan strengthened domestic nuclear support.[52] The Chinese threat diminished in the late 1960s as the United States and Soviet Union became countervailing powers to the Chinese.

The Indian nuclear program received renewed impetus after the Indo-Pakistan War of 1971 as the Indians became concerned about a possible Pakistan-China-US alliance.[53] The US deployment of a carrier task force to the Bay of Bengal, meant to signal India not to go too far, may have been the single most critical event of the war.[54] Although India claimed it was not impressed, it may have given pause to rethink its position about the subcontinent strategic balance. President Nixon and Secretary of State Kissinger's attempts at rapprochement with China during this time further complicated the issue.[55] In addition, immediately after the war, Indian intelligence learned of a cabinet meeting held by Pakistan's new prime minister Zulifikar Ali Bhutto. In January 1972 he was reputed to state that his countrymen would "eat grass," if necessary, to get the bomb. On May 18, 1974, India became the sixth nation to explode a nuclear device, an explosion labeled a peaceful nuclear explosion by the Indians.

In addition to serving as a strategic hedge against Chinese and Pakistani nuclear and conventional capabilities, India gains domestic and international prestige by

maintenance of a nuclear capability. This may be even more accurate today as India's previous major political and military ally, the Soviet Union, has broken up while China has expanded its influence as a regional power.[56]

Resources. Although India has become the world's tenth largest industrial power (measured by assets), it still has a per capita income of only about $300 a year.[57] India spends less than 4 percent of GNP on defense, even though this amount probably does not include its investment for the nuclear infrastructure.[58] India did announce in 1990 an increase in military spending to a level of $9.3 billion. India increased its armed forces by 6.2 percent from 1977 to 1987, while Pakistan allowed its forces to decline.[59] In fact, India's military is now the fourth largest in the world.[60]

"It is important to note that the growth of nuclear and space programs in India is a spin-off from the growth of Indian technological know-how and capability."[61] With the third largest pool of scientists and engineers in the world (after the United States and the former Soviet Union), India has an indigenous source of elite nuclear and space scientists and engineers. The availability of technology has driven development needs. This development in the civilian nuclear and space programs has given India nuclear weapons and delivery systems.

India's indigenous nuclear facilities, originally constructed with assistance from the United States, Canada, and France, are the foundation of India's nuclear capability. When these countries stopped technical support after the 1974 test, India set about developing its own nuclear production support capability that has been largely successful, with noteworthy problems in production of adequate heavy water supplies.[62] The facilities

remain outside the IAEA system (unsafeguarded) and provide India with enough materials to theoretically produce up to thirty nuclear weapons annually.[63]

Capability. Kathleen C. Bailey summed up India's known nuclear capability: "While there is currently no indisputable evidence that India is building a nuclear arsenal, it is clear that India is capable and prepared."[64] India has continued to assert that it does not possess nuclear weapons and does not intend to develop them.[65] Official claims aside, India has the capability to produce a large supply of plutonium; its nuclear program may have resulted in as many as 60 nuclear weapons.[66]

India also possesses a growing missile delivery capability. In 1967, India started developing sounding rockets and by the 1970s began developing satellite launch vehicles (SLVs).[67] In 1980, India launched a satellite using its own SLV-3 and in 1988, India successfully tested its Prithvi short-range ballistic missile, a single-stage liquid-propellant system. In May 1989, India conducted a successful test of the two-stage Agni ballistic missile.[68] This first stage is a solid propellant stage based upon the SLV-3 with a second liquid propellant stage that is a modified Prithvi. The Agni has a range capability exceeding 600 kilometers and a payload capacity in excess of 1,000 kg.[69] Some speculate that India's next step is development of a solid-propellant SLV capable of placing a 3,000 kg spacecraft in polar orbit. A missile of this type would enable India to build ICBMs. There is also concern that India is interested in developing cruise missiles.[70] In addition to providing India with a possible delivery vehicle for nuclear weapons, these resources give India prestige. "Countries have viewed missile possession as a mark of technological prowess and status."[71]

India also possesses aircraft delivery systems capable of delivering nuclear weapons. With a fleet of Jaguars, Mirage-2000s, and MIG-29s, India has the ability to deploy aircraft capable of dropping nuclear weapons on all of Pakistan's major cities.[72] Pakistan is a long, narrow country particularly susceptible to air strikes from India.

On the Two-Tier Proliferation Model, with approximately 60 nuclear weapons and the means to deliver them, India has a fairly limited capability. This capability could grow, however, as their missile technology continues to mature and the quantity of weapons increase.

Will to Use. In January 1988 Pakistan and India signed an agreement that entered into force in January 1992 not to bomb each other's nuclear installations, significantly reducing the potential for preemptive strike.[73] The conventional arms race may have also slowed or halted, further stabilizing the region.[74] After the 1990 Kashmir conflict, military leaders of the two nations agreed "to resume weekly meetings and to negotiate an advance notification agreement to cover military exercises."[75] A telephone hot-line link established between the two countries may serve to further defuse the situation.[76] The decision to downplay conflict may well be a recognition that in a nuclear exchange neither side would be the victor. Both countries share a densely populated common border. A nuclear explosion in either country would do harm to both countries.

Although India may have a nuclear capability vis-à-vis China, perhaps Indian intentions regarding China hinge as much on prestige as actual deterrence.[77] India may prefer to delay acknowledging a deterrent capability until it is qualitatively equivalent to the Chinese deterrent. While China does not appear to be using its nuclear capability to coerce India as it may have attempted during the 1965 and 1971 Indo-Pakistan wars, it

seems apparent that India will continue to develop a nuclear capability to serve as a future deterrent to a conventional crisis (such as occurred in 1962) or Chinese nuclear posturing.[78] To the Indians, this may appear even more important with the Soviet collapse and America's renewed friendship with China.

There is little question that India would use nuclear weapons to ensure national survival, but would India use them in response to national security interests such as a renewed battle for Kashmir? In a first-strike scenario, probably not. India's conventional forces are superior to those of Pakistan and using nuclear weapons preemptively seems unlikely; however, retaliating against Pakistan if it used nuclear weapons first seems entirely likely. Therefore, India is assessed as having a moderate will to use nuclear weapons on the Two-Tier Proliferation Model.

Pakistan: Desperately Seeking Deterrence

A nuclear capable India threatens Pakistan's very existence and has provided an overwhelming incentive to develop nuclear weapons. Despite pressure from the international community, particularly from the United States, it appears Pakistan became nuclear capable sometime in the late 1980s. In 1987, a Pakistani scientist admitted in an interview with an Indian newspaper that Pakistan already had the bomb.[79] Pakistan has an extremely limited capability with a moderate will to use its nuclear arsenal, which is assessed to be slightly less responsible than India's.

Motivation. When it became apparent that India had developed a nuclear capability, Pakistan felt compelled to do likewise.[80] Although it has always been nearly impossible for Pakistan to match India's overwhelming conventional capabilities, when

India developed nuclear weapons, the situation seemed even more desperate. Pakistan needed a capability to deter not only a larger conventional capability, but an emerging nuclear arsenal as well.

Although Pakistan's nuclear program is primarily designed to counter India's military and nuclear might, there is also substantial incentive to establish power and prestige in the Islamic world.[81] Pakistan perceives itself a leader among Muslim states. Possessing the sophisticated technology and resources to develop nuclear weapons will go a long way in placing Pakistan in the limelight of respect and admiration from states like Iran, Iraq, and Libya. With such international notoriety, Pakistan assumes a unique position to represent Islamic interests throughout the world.

Resources. Pakistan's economic commitment to both its military in general and its nuclear weapon program specifically has been substantial, with about 7 percent of GNP spent on defense in the late 1980s. Human resources include a relatively large scientific community with research facilities located throughout the country. The Pakistan Institute of Nuclear Science and Technology, established in the early 1960s near Islamabad, is the nation's premier nuclear training and research center.[82]

Pakistan initially followed the same path as India in seeking fissile materials. Pakistan, however, lacked the resources to develop a plutonium reprocessing capability—purchasing one was the only alternative. Shortly after Canada provided a heavy water reactor in 1972, Pakistan began negotiations with France for reprocessing technology, equipment, and facilities. When India detonated a nuclear weapon in 1974, international concern over Pakistan's true motives for nuclear technology pressured France into canceling portions of the contract.[83]

With legal avenues for technology and materials closed to Pakistan, theft became the only alternative. Blueprints and a list of component suppliers essential for the construction of a centrifuge enrichment facility were taken from a research facility in the Netherlands. Even though Pakistan had little money and technical expertise, the facility at Kahuta was built by circumventing export controls and technology transfer restrictions.[84] By 1984, Pakistan possessed a uranium enrichment capability and had obtained high explosives technology, also from illicit sources. While Pakistan has not detonated any nuclear explosives, such tests are rarely necessary anymore, since modern non-destructive techniques can provide confidence that nuclear weapons will perform as designed. In fact, Pakistan may have obtained nuclear warhead design information from the Chinese, who have had an effective nuclear weapons program for many years.[85]

Capability. While the exact number of Pakistani nuclear weapons is unknown, US intelligence suspected it had six to ten weapons in 1993.[86] Since Pakistan is not a signatory to the NPT,[87] and because there is no inspection evidence, actual numbers of weapons, as well as their location and assembly status, is largely speculative.[88]

Pakistan's main adversary, India, is within range of several of its conventional delivery systems that can also carry nuclear weapons. In fact, cargo and fighter aircraft (such as numerous F-16s)[89] require little, if any, adaptation to carry today's small nuclear weapons.[90] In 1989, Pakistan tested two short-range ballistic missiles, the Haft 1 and 2, which are believed to be based on Chinese technology.[91] With large numbers of Indians packed into urban areas within fairly short distances from Pakistani borders, these cities could become lucrative countervalue targets.[92]

Since Pakistan has no impetus to develop a large arsenal with global range, its presumed capability is therefore relatively small. Based on the 1993 information of having six to ten weapons, today's stockpile could hardly be more, certainly less than 20 weapons.[93] On the Two-Tier Proliferation Model, Pakistan is assessed as having a very limited nuclear capability.

Will to Use. Neither Pakistan nor India is keen to wage full-scale war against the other, but each admits the possibility of another clash over Kashmir.[94] However, "deep-rooted suspicions and mistrust" hinder attempts to seek a long-standing agreement of peaceful coexistence between the two.[95] Nonetheless, the Pakistanis understand the futility of nuclear war. They understand its economic impact and the threat of mass destruction on the subcontinent. Pakistan's population would be so close to the fighting that they would have no retreat once fighting broke out.[96] Moreover, given the huge numbers of Muslims throughout India, it would be hypocritical of Pakistan to target cities, killing the very people it has pledged to defend.[97]

It can be fully expected, however, that if Pakistan were attacked with nuclear weapons, or if Pakistan felt its sovereign existence were threatened, Pakistan would respond with nuclear weapons.[98] In all likelihood, Pakistan would not use nuclear weapons for a preemptive strike early in any war (there is no evidence that their military is trained in nuclear weapons techniques or responses in a nuclear environment).[99] However, in 1990 Pakistan placed its nuclear arsenal on alert in response to India's deployment of its armored tank units along the Indian border.[100] Pakistan could conceivably use nuclear weapons in response to an overwhelming Indian conventional capability. Therefore,

Pakistan's will to use nuclear weapons is assessed to be slightly higher than India's, which places it in the middle third of the Will to Use axis on the Two-Tier Proliferation Model.

Israel: Afloat in an Arab Ocean

Mordechai Vanunu's revelations to the *Sunday Times* of London provide substantial corroborating evidence that Israel, long suspected of having nuclear weapons, crossed the threshold from Tier One of the Two-Tier Proliferation Model into Tier Two sometime in the late 1960s or early 1970s. Surrounded and outnumbered by several hostile Arab nations, it is easy to see why Israel has pursued the nuclear option. With Israel's primary concern as national survival, Israel is assessed to have a somewhat moderate nuclear capability (albeit substantial from a regional perspective), but a fairly responsible will to use it.

Motivation. There have been six major wars between Israel and the Arab states in the past 44 years and continual violence at the sub-national level. The region has also seen a number of Arab interstate wars, and support for violence across states borders.[101] This long tradition of war has created a distinct pattern of thought, behavior, and national security policy among the region's political and military leaders. The internal and external incentives to proliferate reflect the security strategy of national leaders. For them, strategic orientation starts with a search for a solution to two fundamental problems: the problem of the balance of forces, and the problem of strategic depth. This dual challenge has no ready answer due to a significant Arab advantage in resources, specifically manpower, and because of borders which are difficult to defend.[102] Israeli military survival depends upon creating a military force that efficiently exploits all available

resources. One such resource is nuclear. Therefore, by necessity the nuclear dimension plays an important role in national security interests.

Israel's nuclear weapons program started more than three decades ago with laying the foundation for the nuclear reactor at Dimona. It was a strong and autocratic leader, the nation's first prime minister David Ben-Gurion, who decided virtually single-handedly, and under tight secrecy, to initiate a dedicated national nuclear project.[103] The push to develop a nuclear capability centered on Israel's national security policy. The foundation of this policy is the assumption that the Arab-Israel conflict is inherently and unalterably asymmetrical with the Jewish state remaining the weaker party. Ben-Gurion echoed this sentiment before the Knesset when he said, "the Jewish state is surrounded by a great Arab ocean extending over two continents. This ocean is spread over a contiguous area [of] seventy million people, most of them Arab-speaking Moslems."[104]

Influences on the political landscape extended beyond Ben-Gurion's stated security concerns. Public fear of an Arab bomb and the refusal of Israel's adversaries to negotiate a permanent peace settlement were key factors in the Mapai party's political agenda. In a November 1963 *New York Times* article, ex-Prime Minister and party leader Ben-Gurion said that nuclear energy cannot be ruled out, "because Nasser won't give up, nor will he risk war again until he is sure he can win. This means atomic weapons—and he has the largest desert in which to test."[105] In April of that same year, former Army Chief of Staff, Moshe Dayan, wrote an article for an Israeli newspaper urging Israel's industry to keep pace with Egyptian President Nasser's effort to build nuclear weapons.[106] This was the political position held by nuclear hawks and it was continually fueled by Arab rhetoric. Following the Six Day War, the Arab states reaffirmed their total rejection of Israel in

their post-war Arab summit in Khartoum. The summit produced three "Arab no's:" no peace, no negotiation, and no recognition.[107] Thus, the development of an Israeli nuclear capability became an option for a future nuclear strategy if Israel found it impossible to maintain a balance of conventional forces against hostile neighbors, or if an Arab nuclear capability became a reality.

Nuclear development has carried with it considerable international risk. Moshe Dayan's unilateral action to push Dimona into full-scale production made it impossible to sign the NPT, which jeopardizes economic and military aid from the United States.[108] In June 1968 Prime Minister Eshkol made a plea to Washington for the sale of F-4s to balance the Soviet introduction of MIG-21s into Egypt. Secretary of Defense Clifford favored tying the sale of F-4s to Israeli acceptance of the NPT, and President Johnson went so far as to write a memorandum to Eshkol persuading him to do so.[109] Israel did not sign, but the sale proceeded.

Though Israel stated that it will not be the first nation to "introduce nuclear weapons into the Middle East," it has never explicitly defined what this phrase means.[110] This ambiguity, coupled with the fact that Israel did not sign the NPT and its clearly visible efforts to construct a nuclear weapon infrastructure at Dimona, has produced an opaque posture. Opting for opacity as a permanent condition has served Israeli interests. Under this veil Israel has been able to continue development and deployment of nuclear weapons without international interference.

Resources. Economic conditions in Israel showed a relatively strong performance during the period when efforts to develop a weapons program went into full swing. For the two decades after 1952, the annual growth rates of population, GNP, and GNP per

capita were about 3.6 percent, 9.1 percent, and 5.3 percent respectively.[111] During this same period, government consumption ran at an average annual rate of 43 percent of GNP, with roughly half of government spending going toward defense. Put in 1990 constant US dollars this equates to defense spending of approximately $3 billion.[112] These figures illustrate Israel's commitment for strong defense and the ability to channel relatively large sums of money into the defense establishment.

In the fall of 1956, France entered into a secret agreement with Israel to build a nuclear research reactor capable of producing 24 megawatts of power and intended for plutonium production.[113] However, the reactor built near the city of Dimona reached far greater capability than the initial 24 megawatt size mentioned in Israeli sources. Its cooling capacity suggested to Western experts that the plant operated beyond this level. Vanunu reported that the capacity of Dimona had been enlarged at least once (from 26 megawatts to 70 megawatts) and that the materials required for hydrogen weapons were being produced.[114] If operated at almost three times the official capacity, the Dimona facility would be capable of producing more than 22 kilograms of plutonium per year, enough for four nuclear bombs.[115] From this information, it can also be deduced that Israel not only possesses more weapons than previously thought, but that the arsenal might include hydrogen, tactical, and enhanced-radiation warheads.[116]

Through various means, both legal and illicit, Israel was able to obtain fissile materials and construct weapons production facilities. The French-Israeli agreement also called for the construction of an underground plutonium processing plant. The plant was completed in 1966.[117]

To fuel the reactor, Israel used natural uranium obtained from various sources. In addition to their own natural sources, Israel purchased natural uranium from French controlled mines in Africa and Argentina.[118] Israel also secretly obtained 200 tons of *yellow cake* by diverting at sea a cargo shipment presumably meant for another destination. Finally, Israel was able to obtain 100 kilograms of enriched uranium by stealing it from a uranium fabrication plant in Apollo, Pennsylvania, in the mid-1960s.[119] A second key element for the reactor was heavy water. Israel is known to have obtained more than sufficient quantities (22 tons) of this material from Norway in 1959.[120]

Capability. Although Vanunu's estimated output of the Dimona facility would place the Israeli warhead count between 100 to 200 in 1986, some Western experts dispute these numbers. By 1992, the most conservative estimates credited Israel with an arsenal of 50 to 100 warheads, at least some of which are thermonuclear designs.[121]

As a result of its mass allocation of resources to national defense, Israel maintains a wide range of weaponry capable of delivering nuclear warheads. Perhaps the simplest and most abundant delivery means available is Israeli Air Force aircraft. This force currently consists of 112 F-4s, 63 F-15s, 209 F-16s, and 95 Israeli Kfir jet fighters.[122] The main problem with aircraft delivery systems, however, is their reliance on airfields. Using aircraft, Israel cannot achieve a credible second-strike capability. Concealment, secrecy, and dispersion are limited by Israel's territory. Hardening and mobility are limited by budgetary considerations.[123] Under these circumstances, the problem then becomes one of *use or lose*. The aircraft option also suffers from the small geographic area in which to operate. Given the time and distances involved, tactical aircraft taking off from its base is analogous to American bombers flying to their positive control turn-around points.

Various sources report that on September 2, 1978, an American satellite over the Indian Ocean recorded two distinctive bright flashes of light. According to Seymour Hersh in his book, *The Sampson Option*, "former Israeli government officials, whose information on other aspects of Dimona's activities has been corroborated, said the warhead tested was a low yield nuclear artillery shell that had been standardized for use by the Israeli Defense Forces."[124] This indicates another possible delivery system for Israel and, perhaps more importantly, that Israel has pursued warhead miniaturization. The US facilitated Israel's movement toward nuclear artillery capability by approving the sale of long-range 175mm and 203 mm cannons in the early 1970s. These weapons have a striking distance of 25 miles and have likely become part of Israel's nuclear option.[125]

Ballistic missiles represent a third category of delivery systems available to Israel. The Israelis currently have 20 older Lance missiles with a 130 km range. Each Lance can deliver a single nuclear warhead with a yield of 100 Kt. They also possess between 170-230 Jericho 1 missiles with a 500 km range. This missile is similar to the Pershing 1 in terms of performance and warhead capability. One hundred Jericho 2 missiles are deployed with a vastly improved range of 1,500 km in the Negev Desert and Golan Heights. This system is supported by a network of underground railroads and nuclear-hardened facilities. It is road mobile and can be launched from flatbed rail cars.[126]

On September 19, 1988 Israel launched its first satellite into low earth orbit, bringing it a step closer to having an ICBM program. US experts concluded that the rocket booster produced enough thrust to deliver a small nuclear warhead.[127] This missile has been designated the Jericho 3 and has a range of 4800 to 7250 km.[128] Additionally,

Israel installed a supercomputer at the Technion in Haifa. This indicates an increase in design capabilities and may indicate a desire to MIRV their missiles.[129]

The command and control of Israel's nuclear weapons appears to be divided between the government and the military. During the 1973 war, then Minister of Defense Moshe Dayan, issued an instruction to prepare nuclear weapons. Dayan referred the issue to Prime Minister Golda Meir who took it to the "War Cabinet," which countermanded the order. From this, it appears that the physical control of the weapons was in the hands of the Defense Ministry, while the decision to use them came from top government officials. One can also conclude from this episode that Israel did not use a complicated series of codes or secure electronic locks to control the weapons.[130]

As an emerging nuclear power, Israel's nuclear capability is fairly extensive and continues to grow. The multiple means of delivery and the possibility of thermonuclear design places Israel near the mid-point of the capability axis in the Two-Tier Proliferation Model.

Will to Use. Israel's strategic concept calls for the use of nuclear weapons when national survival is at stake. Israel's decision to employ nuclear weapons emanates from the realization that it lacks strategic depth. Due to Israel's size and limited area for maneuverability, there is no tradeoff between space and time. In the event of a combined Arab attack, reliance on strategic reserves for total mobilization remains an inherently weak position. The time required to call reserves into action may exceed that required by the opposition to achieve a decisive strategic advantage.

Yair Evron points out in his book:

> The opaque posture hardly has any credibility as a deterrent against all types of limited or attrition war fought for limited political objectives (such as wars to gain territory). But, the same posture, nonetheless, plays a role in deterrence of a war launched by a grand Arab coalition against Israel.[131]

In a total war where the existence of the state is threatened, the aggressors might encounter Israel's weapon of last resort. For this reason, Israel has had to maintain a conventional military capability to combat limited territorial wars, and an independent nuclear option for the very specific purpose of deterring aggression which threatens national survival.[132]

Many factors could obscure when national survival is at stake. Although Israel possesses an advanced and sophisticated early warning system, the problems faced by Israeli decision-makers are without precedent. First, there is the multi-polar structure of the Middle East. In the war between Syria and Jordan in 1970 there was a notable increase in air traffic on Israel's borders. Given the belligerents common hostility toward Israel, their actions could have led to a misinterpretation of intent and subsequent response by Israel. Second, there is the highly plausible scenario of a third party instigating a conflict. Through deception or direct attack, a third party can give the appearance of catalytic action, thereby preserving itself at the expense of another hostile nation. The third problem stems from the possibility that nuclear systems may be developed and located in the same general geographic area. If, for example, missile attack boats were positioned in the eastern Mediterranean, it would be difficult to identify the source of an attack.[133] Since a single strike in one vulnerable urban center would be disastrous, the incentive to strike preemptively is hastened.

Granted it may be difficult for Israel to determine exactly when their national survival is at risk, Israel has nevertheless indicated this would be the only reason they would use nuclear weapons. This places Israel fairly low on the will to use axis on the Two-Tier Proliferation Model; lower in fact than India or Pakistan.

Plotting Actors on the Two-Tier Proliferation Model

Now that the three actors that have been characterized in terms of motivation, resources, capability, and will to use, they can be plotted on the Two-Tier Proliferation Model.

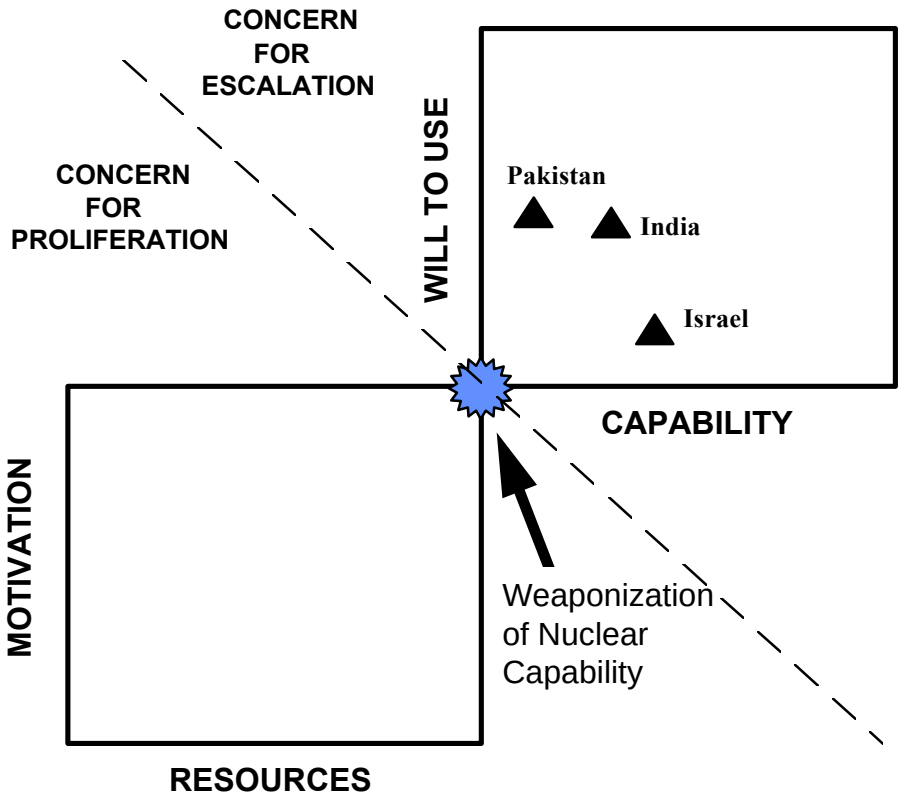

Figure 6: Two-Tier Proliferation Model with Countries Plotted

As Figure 6 indicates, India, Pakistan, and Israel reside in Tier Two, but in the most desirable region—the lower left quadrant. Countries residing in this region require nuclear control regimes to minimize the potential for escalation and to dissuade them from entering into a regional arms race or from initiating destabilizing practices. Having characterized and plotted these proliferators on the Two-Tier Proliferation Model, specific recommendations can be made to improve safety, security, and stability of their nuclear arsenals. A wide range of nuclear control measures are defined in Chapter 5 for potential application to these actors. Chapter 6 explains how these measures can be developed into nuclear control regimes to limit or reduce India, Pakistan, and Israel's nuclear capability and will to use nuclear weapons.

CHAPTER 5

Nuclear Control Measures

Introduction

From a historical perspective, the safety, security, and stability of nuclear arsenals has been of paramount concern to nations that have chosen the path of proliferation and have declared the existence of their nuclear forces. Despite deployment of tens of thousands of nuclear weapon systems since the attacks on Hiroshima and Nagasaki, not a single accidental or unauthorized nuclear explosion, seizure of a nuclear device, or intentional detonation against an adversary has occurred.[134] This remarkable record has been achieved through the rigorous application of measures designed to increase safety, security, and stability of the declared nuclear powers' arsenals. As mentioned in Chapter 1, nations motivated to develop a nuclear capability will continue to do so. With an eye toward increasing the safety, security and stability of these arsenals, the emerging nuclear nations can benefit from 50 years of US experience.

This chapter briefly defines the goals of safety, security, and stability. It then introduces specific procedures, design criteria, and policy measures that can be used to enhance the safety, security, and stability of nuclear arsenals. Drawing from these measures, Chapter 6 will propose nuclear control regimes that lower Pakistan's, India's, and Israel's *capability* and/or *will to use* their respective nuclear arsenals. Figure 7 presents an overview of the nuclear control measures described in this chapter to enhance safety, security, and stability.

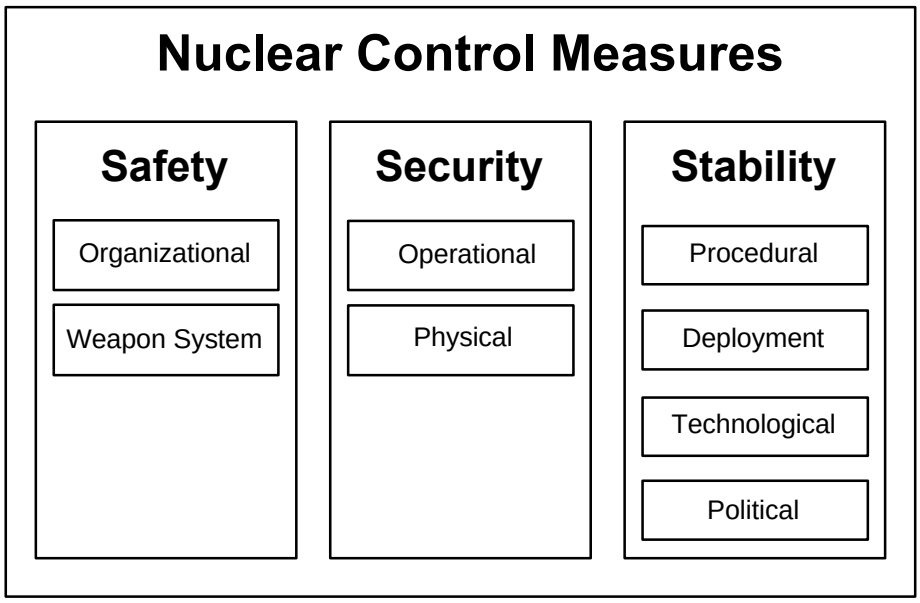

Figure 7: Categories of Nuclear Control Measures

The Goal of Safety. Safety ensures that nuclear weapons and weapon systems are designed, maintained, transported, stored, and employed in a manner consistent with maximum safety.[135] To achieve the desired level of safety, custodians must adopt measures that prevent nuclear weapons involved in accidents from producing a nuclear yield and guarantee against inadvertent prearming, arming, launching, firing, or releasing of these weapons.[136] From the very beginning of the US program, safety procedures and technology were integrated into the use of nuclear devices. Procedures developed for the *Enola Gay* mission to Hiroshima included removing the explosive charge from the bomb until the aircraft was airborne. US scientists also incorporated technical safety devices in the form of electronic switches into the bomb. These switches prevented detonation outside of specific time and altitude parameters.[137] Present state-of-the-art technical

safety, coupled with institutionalized procedures, comprise a set of reliable tools for developing acceptable safety standards.

The Goal of Security. Security prevents unauthorized prearming, arming, launching, firing, or releasing of nuclear weapons.[138] Security also prevents unauthorized access, damage, sabotage, or loss of nuclear weapons, while ensuring that they remain operationally available. Along with safety measures, security measures were developed early in the American program. In 1945, security personnel established a secure perimeter around the *Enola Gay* while parked on Tinian to prevent unauthorized personnel from gaining access.[139] Security procedures such as these work in concert with safety and stability measures to produce a positive synergistic effect. For example, denying unauthorized personnel access to nuclear weapons decreases the likelihood of intentional or unintentional breaches in established safety standards.

The Goal of Stability. Stability measures prevent arms racing and escalation in the quantity, range, and yield of weapons by holding the nuclear capability of potential users to a level consistent with security interests. In general, stability measures include specific procedures, deployment schemes, technology, and political arrangements that reduce the need for rapid nuclear responses by nations involved in political or military conflict. A situation may give rise to rapid military response when sides in the conflict lack survivable systems, sufficient warning to evaluate a possible attack, misinterpret or fail to interpret correctly the intentions of the other parties, or simply adopt a preemptive-use posture. Armed with an awareness of the stabilizing and destabilizing effects of specific actions, nations can rationally embrace activities consistent with both a stable environment and their own interests.

Safety Measures

To highlight the broad range of safety measures available to proliferators, this category has been further sub-divided into organizational safety and weapon system safety categories.

Organizational Safety. These practices, procedures, methods, or rules have been established to reduce the possibility of an accident involving nuclear weapons and associated critical materials. They define personnel behavior associated with those individuals working on or near nuclear weapons, to include operations, maintenance, and security personnel. Organizational safety measures ensure that only authorized, qualified, and reliable individuals operate or maintain nuclear weapons systems.

Training. Education and training are essential elements of an overall nuclear safety program. Personnel must receive training in all facets of nuclear safety before being allowed to work with nuclear weapons, perform nuclear-related duties, or control access to nuclear weapons. A sound training program should include, as a minimum, accident prevention, safety rules and procedures, accident response, personnel reliability issues, hazard reporting, and procedures for movement and storage of nuclear weapons.[140] Following initial training, refresher training should be accomplished periodically to maintain currency.

Personnel Reliability. Not all individuals possess the character, integrity, and maturity to operate, maintain, or provide security for nuclear weapons. A process to screen, select, and monitor responsible individuals is a critical aspect of organizational safety. This is accomplished through comprehensive records reviews, in-depth

background investigations, and interviews by certifying officials.[141] Once certified as reliable, each individual is monitored by their supervisor, coworkers, and themselves to ensure reliability. Medical situations, stressful events, or irrational behavior are grounds for suspension. The overall goal is to ensure each individual working with nuclear weapons remains physically competent, mentally stable, and morally loyal to the organization responsible for nuclear weapons.

Certification. Weapon system hardware and software, communications systems, and operating and maintenance procedures must be evaluated and certified against nuclear safety criteria before use with nuclear weapons.[142] Certification ensures compliance with applicable safety rules, weapon system restrictions, and safety features. This applies to the nuclear weapon, delivery vehicle, handling equipment, test equipment, specialized tools and equipment, spare parts and materials, support equipment, and technical manuals. Certification is designed to prevent accidents and mishaps by ensuring safety margins are maintained throughout the life of the weapon, and ensuring personnel use only validated methods and procedures for operating and maintaining the weapon system.

Unauthorized Use Analysis. Every weapon system should be thoroughly analyzed to determine potential vulnerabilities to unauthorized use.[143] Each nuclear safety and security feature should be evaluated to determine the potential for overt or covert exploitation. Individuals participating in, or having access to, these studies must never be allowed to operate, maintain, or provide security to the nuclear weapon system. Vulnerabilities discovered during analysis must be mitigated through safety and security measures to the maximum extent possible.

Accident Response. Emergency response teams must be immediately available to respond to an accident. Accidents can vary from minor incidents to catastrophic events. Response capabilities should be exercised regularly and contingency plans established to counter potential problems. Mechanisms for civil-military cooperation are essential, as are mechanisms for international involvement should the accident grow beyond territorial boundaries or exceed domestic response capabilities. Accident response capabilities include emergency ordnance disposal, public affairs, security forces, bioenvironmental teams, legal, medical, and civil law enforcement authorities, and other personnel as deemed appropriate.

Execution Message Procedures. Well-defined, unambiguous methods and procedures must be established to allow force direction between the release authority and military members responsible for employing nuclear weapons. Release instructions must be clearly communicated and understood. Encryption and decryption procedures, along with a system to confirm the authenticity of the release authority, must be in place. Communication systems and procedures must prevent the possibility of hostile insertion, interruption, or modification of message traffic between the release authority and those employing nuclear weapons.

Strategic Nuclear Material Monitoring. A clear audit trail must be established for each and every gram of weapons grade fissile material created. This material must be afforded the highest degree of protection and monitoring at all times. As the material is processed for application in nuclear weapons, custody is formally transferred each step of the way. Even waste from the manufacturing process is monitored and accounted. An audit of material used in operational weapons, testing,

research and development, and manufacturing waste must equal the amount originally created. This prevents undetected losses of critical materials.

Weapon System Safety. This category of safety refers to measures that aim to achieve a greater degree of safety in nuclear weapon systems via design criteria, use of reliable materials, safety enhancing devices, and technology-based safety measures. These weapons system design features reduce the likelihood of a nuclear accident.

Insensitive High Explosives (IHE) and Fire Resistant Pits (FRP). The House Armed Services Committee Panel on Nuclear Weapons Safety reported that IHEs and FRPs "are the two most critical safety features currently available for avoiding plutonium dispersal in the event of aircraft fires or crashes."[144] Fission and multi-stage thermonuclear weapons use high explosives (HE) to achieve the compression necessary for initiating a nuclear chain reaction within the pit, or core, of the weapon.[145] Although HEs are stable, extreme shock, thermal exposure, and pressures can cause non-nuclear detonation. Such a detonation will disperse plutonium from the weapon's pit. IHE by contrast will not detonate unintentionally in extreme environments.[146] The FRPs further reduce the likelihood of plutonium contamination in fire accidents involving IHE. Current FRPs provide protection at 1000 degrees centigrade for several hours before becoming molten.[147]

Enhanced Nuclear Detonation Safety (ENDS) Systems. ENDS systems prevent premature arming of nuclear weapons subjected to abnormal environments. The concept involves electrical isolation of components critical to the detonation of the warhead. In order to arm the weapon, a series of electric links must be closed. Some links require specific operator-coded inputs or environmental input corresponding to flight

trajectory for activation. Others are designed to irreversibly fail when the environment exceeds safe parameters.[148]

Command Disabling Devices. A relatively recent feature on some American weapons is the ability to disable warheads through non-violent means. The command disabling devices are integral components of the warhead that render the weapon useless when activated. To enhance the safety of the system, personnel who find themselves in a situation where weapons are likely to fall into the hands of unauthorized individuals can enter a disabling code and manually activate the disabling device. The code system, in addition to transmitting the disabling command, protects the integrity of the system from individuals wishing to disable the weapon without proper authority.

Armed and Disarmed Indicators. These devices provide a means for handlers and nuclear weapon custodians to visually verify the state of the warhead through a mechanical or electro-optic device. Warheads remain in the disarmed state and are incapable of producing a nuclear yield until receipt of orders from an authorized source. During transportation, maintenance, and storage, authorized nuclear handlers must verify that the weapon is disarmed. This reduces the possibility that personnel working on or around nuclear weapons can inadvertently or deliberately cause the weapon to produce a nuclear yield.

Security Measures

Security measures are divided into two categories, operational security and physical security. Operational security maintains command and control over nuclear forces, while physical security prevents unauthorized access to nuclear weapons.

Operational Security. Strict control over the processes and equipment used to command and control nuclear forces is essential. Split knowledge and split operations ensure no single individual has access to the necessary information and hardware to allow unauthorized use of nuclear weapons. Secure and redundant communications link the authority to release weapons with those operating them, and prevent intrusion or jamming by hostile forces.

Enable Codes. One measure to prevent the unauthorized use of nuclear weapons is the employment of enable codes or Permissive Action Link (PAL) codes. These codes are required to *unlock* nuclear weapons and prepare them for use. Those individuals operating, maintaining, or providing security for nuclear weapons do not have access to these codes until immediately prior to execution. Enable codes can be transmitted to the weapon prior to, or along with, execution messages. Three measures can make these codes extremely effective and significantly enhance security.[149] First, enable codes should be possessed as high up in the chain of command as possible. Ideally, the individual or agency that possesses execution authority would also possess the enable codes. This prevents compromise by individuals who do not possess execution authority. Second, the more selective the enable codes, the better. Rather than one code unlocking the entire force, codes that selectively unlock individual weapons would provide a much greater degree of control and security. Finally, the codes should be reversible and perishable. Once weapons are unlocked, there needs to be a capability to *relock* them. The original code should be perishable so that it cannot unlock the weapon again—a new code would be required.

Code Custodians. Certain components of a nuclear weapon system are designed to prevent unauthorized or inadvertent use. These components may require special coding operations. Personnel designated as code custodians perform these operations. Because of the critical nature of the information to which they have access, code custodians must never be part of an operations crew, maintenance team, or security force. Their roles and responsibilities are unique and must be kept separate from day-to-day activities associated with the weapon system. To provide added security, code sequences can be divided into portions so that no single code custodian has knowledge of an entire enable, launch, or other release authorization code. In this manner, split knowledge is applied to all code custodians to reduce the potential for unauthorized use of the weapon.

Functional Separation. Those organizations responsible for weapon system design, development, testing, and acquisition should be separate from those responsible for weapon system deployment and use. This functional separation ensures limited knowledge on the part of those operating, maintaining, and providing security for nuclear weapons once they are assembled and fielded for use. Each functional group establishes control capabilities and procedures not known by the other. This makes it less likely that any single individual would have the knowledge to bypass all security features built into the weapons and weapon delivery systems.

No Lone Zones. Areas allowing access to nuclear weapons or weapon system critical components are designated no lone zones.[150] No lone zones require at least two reliable individuals be present during any operation in the area. Each individual must be knowledgeable of the task to be performed and capable of detecting an unauthorized

act. This concept ensures no single individual is allowed access to a nuclear component or a nuclear weapon.

Reliable and Survivable C4 Systems. Command, control, communications, and computer (C4) systems are susceptible to both conventional and nuclear attack. New nuclear states must construct attack-resistant communications systems that allow responsible national leaders to retain control of nuclear weapon systems in the event of hostilities. Although radio links are susceptible to jamming, survivability can be enhanced by employing multiple, redundant communications and computer networks, using the entire electromagnetic spectrum. The US and former Soviet Union also used airborne repeaters and command elements to deliver emergency action message (EAM) traffic, independent of vulnerable ground stations. To enhance reliability and survivability, C4 systems should thoroughly interconnect users via multiple paths without reliance on nodes that could constitute a single point of failure.[151] Communication systems architects should consider hardening the C4 network against blast and electro-magnetic pulse. Finally, a reliable nuclear command and control system must guarantee unconditional security by restricting access. This can be accomplished through electronically encoded EAM traffic, hardened and alarmed cable networks, or use of one-time encryption/decryption key codes.

Physical Security. These measures prevent unauthorized physical access to nuclear weapons. Storage, transportation, and operational configuration of weapon systems should be designed to provide maximum security and minimize the potential for unauthorized access or physical loss.

Physical Separation of Warheads and Delivery System. Physical separation provides added security for nuclear weapons by preventing unauthorized personnel access to both the nuclear warhead and the means for delivery of the warhead. Nuclear weapons should be stored in a secured facility until there is an operational need to load the weapons onto delivery systems. This, of course, increases the complexity for terrorists or others attempting to seize a usable weapon (a warhead with its delivery vehicle). The recommended separation distance between warhead and launch vehicle will depend upon the operational necessities of the nuclear state.

Impenetrable/Secure Storage. Nuclear weapons, nuclear weapon-grade material, and critical nuclear components should be stored in impenetrable, monitored, hardened bunkers. As with other ammunition facility areas, this should include various restricted zones that circumscribe the nuclear storage area, increasing levels of security as one approaches the bunkers.[152] Construction standards should delay unauthorized entry until security forces can respond. Restricted zones should be delineated with security detection and response systems.[153] Communications, lighting, and other key elements of the security system should have redundant back-up systems (e.g., uninterrupted power system, use of both radio and telephone communications, etc.).

Secure Transportation Measures. Transport of nuclear weapons, critical components, and nuclear materials should be via specially-equipped surface vehicles with secure, redundant communications, and armed security personnel well versed in special security and resource denial procedures. Vehicles transporting nuclear material should be subject to special weather, visibility, and mechanical reliability restrictions. The convoy

route should include pre-designated safe-havens and security arrangements in the event of emergencies, mishaps, or hostile actions.

Air transportation should not be used. It expands susceptibility to hostile action by increasing the physical space, number of personnel involved, and reliance on unarmored transport aircraft. In addition to the security aspect, air transport compounds safety problems by increasing the likelihood that nuclear weapons involved in air mishaps may disperse fissile materials or be lost. An example of such a mishap happened on 17 January 1966, over Palomares, Spain, when a US B-52 crashed. Five crew members were killed and two of the four nuclear weapons aboard experienced non-nuclear detonation on impact, spreading radioactive materials over a large area.[154] This mishap also involved the temporary loss of one nuclear weapon.

Stability Measures

For the sake of clarity, stability measures are separated into procedural, deployment, technological, and political categories.

Stability via Procedural Measures. Countries can adopt graduated responses to warning indicators. An orderly transition from peacetime postures to wartime postures provides nuclear-capable countries the time needed to resolve a dispute without resorting to a nuclear exchange.

Intelligence on Strategic Indicators. Conventional wisdom asserts that a *bolt-out-of-the-blue* nuclear attack is unlikely. Most conflicts include periods of increased diplomatic posturing, application of political or economic instruments of power, and military posturing prior to the outbreak of hostilities. During these pre-hostility phases of

a conflict, activation of crisis management structures at the national level, military command and control (C2) networks, and reconnaissance assets become a top priority.[155] Indicators that signal preparations for a military (and potentially a nuclear) option are transmitted, received, and processed through these channels. These indicators could include increased traffic on military C2 circuits, increased activity at weapons storage sites, increased security at airfields, and attempts to insure the survivability of national leadership by evacuation of key personnel away from the capital. Thus, a comprehensive intelligence effort is required to (a) identify normal peacetime practices, (b) differentiate between exercise actions and crisis situations, and (c) maintain a comprehensive database that records differences between normal, exercise, and crisis activity. An intelligence structure such as this permits nations to accurately analyze strategic warning indicators.

Separate Weapon and Delivery Vehicle Training and Operational Facilities. Activities related to movement and mating of nuclear delivery systems is a prime indication that a nuclear option is under consideration. At the same time, the operators and maintainers of nuclear forces require exercise and training in these same movement and mating activities. Physical separation and identification of operational facilities from training facilities reduces the likelihood that routine training and exercises may be mistaken for a pre-employment action.

Graduated Response to Crisis. The US created the basic procedures for alerting nuclear forces in the late 1950s. These procedures permit central authorities to discretely direct changes in the readiness status of the conventional and nuclear forces. Orders to change alert status, known as Defense Conditions (DEFCON), run from the National Command Authority (NCA) through the military/civilian chains of command.[156]

Five different DEFCONs allow an orderly transition to the highest states of readiness. DEFCON 5 is a normal readiness posture that can be sustained indefinitely. At the opposite end of the spectrum, a declaration of DEFCON 1 indicates that war is considered imminent.[157] Such responses allow belligerents to raise the specter of a nuclear exchange and associated deterrent effects to a level commensurate with the perceived threat. Under these conditions, countries are not forced into irreversible, binary nuclear strike decisions.

Post Attack Assessment. Nuclear nations must have the capability to evaluate the scale of an attack, the targets hit, and status of the surviving retaliatory forces. The intent of post attack assessment is to gauge the scope of the attack, be it limited, or all out. This will allow a proportionate response, and help to avoid premature escalation to a nuclear response.

Stability via Deployment Measures. Some nuclear force deployment schemes run the risk of undermining the perceived balance of power between nations. Nations should, therefore, avoid deployment schemes that require rapid response, launch under attack, or create an environment that prevents detection of attack.

Sovereign Basing. At the height of the Cold War, the United States had thousands of tactical and strategic nuclear weapons on alert throughout the world. Weapons were forward based on allied territories, on submarine and surface vessels, and on long range bombers flying toward positive control turnaround points. World-wide command and control of these forces was complex and challenging. In a proliferated world, however, these practices would be intolerable. Emerging nuclear powers must refrain from basing nuclear weapons outside their sovereign territories. These countries will find command and control, as well as physical security, much easier if nuclear

weapons remain within their territorial boundaries. As such, regional adversaries will be less likely to embark on costly and potentially destabilizing efforts geared at countering the threat of weapons based at sea or on the territory of third parties. Moreover, sovereign basing would reduce ambiguity concerning who initiated a nuclear attack. If, for example, several countries possessed sea-based capabilities, it may be difficult or impossible to determine who was responsible for a nuclear strike. The potential to decrease immediate reprisals, in turn, increases the incentive to strike preemptively. Finally, sea-based systems or basing on allied territory would threaten the security of countries removed from the region of concern. This allows counties to expand the use nuclear power beyond regional interests to global hegemonic purposes.

Alert Status. One should not make a general statement that forces deployed in a high state of readiness are inherently destabilizing. One needs to first define for consideration all the necessary elements of a particular nature of a nuclear force deployment, and then contrast that nature to the stabilizing nature of the US nuclear deterrent forces that existed during the Cold War. From that analytic framework, one can clearly see the interaction of the nuclear confidence measures (NCMs) that made up the US nuclear deterrent force. From that perspective, one can assess the presence or absence of similar NCMs, or presence of different NCMs, and the presence of unique elements in the nature of a particular case. For example, a country in the early stages of deploying nuclear forces and without the unlimited resources that were at the disposal of the two superpowers during the Cold War, may initially deploy its nuclear forces in a high state of readiness without other stabilizing elements: a reliable C^3I, a survivable basing mode, a declared nuclear employment strategy and doctrine, positive controls, a human reliability

program, and defense measures. As a result, their high state of readiness may actually contribute to crisis instability, for they wouldn't necessarily know what was going on in their adversary's country. Concurrently, their adversary wouldn't know under what conditions they would strike with nuclear weapons. Without a clear picture of what is occurring in each relationship, fear of preemption is valid. Had the country deployed a reliable C^3I network or had access to reliable intelligence sources (e.g., purchased commercially available satellite imagery), it might have access to a clear picture of its opponent's actions. But in the absence of these other important elements, a country should be encouraged to eschew the practice of a high state of readiness. This way the Security Council of the United Nations may have the time to intercede to facilitate defusing a crisis before it reaches nuclear employment.

Stability via Technological Means. These measures seek to decrease preemptive attack pressures and enhance force survivability through application or avoidance of technology intensive devices, systems, and designs.

Early Warning Systems. Timely, reliable, accurate, and unambiguous early warning systems provide a clear picture of what is (and what is not) happening. Decision makers must be provided an accurate assessment of what is transpiring during a crisis and, if the situation escalates, during a nuclear exchange. If an attack is launched, information is needed to determine how many weapons are in-bound, who launched them, and where they are expected to impact. This information is necessary to determine the appropriate level of response. Cross-checking information from more than one warning system is essential to verify attack and preclude premature launch of retaliatory forces.

Survivability. This area can create the greatest amount of stability in nuclear forces. The ideal is to have nuclear forces that can survive a preemptive strike and then, if necessary, be executed after a full assessment of the situation is made. This resolves the *use* or *lose* mentality associated with less survivable systems.

Survivability can be achieved through various methods. The first is nuclear hardening. Facilities that house nuclear delivery vehicles, nuclear weapons, and command and control facilities are hardened against the effects of nuclear blast. The normal method of hardening is deeply burying facilities or reinforcing facilities with concrete and steel. The second method is mobility. Rather than maintaining weapons in a fixed hardened facility, this option allows the weapons delivery vehicle, nuclear weapons, and command and control facilities to move from site to site, preventing the adversary from locating and targeting the facilities. The third option is to maintain a state of readiness so responsive that the weapons can be employed *on warning*. This is similar to maintaining aircraft on strip alert, which can be launched for survivability. Each of these three basic approaches to survivability have their own advantages and disadvantages. Mobility is a highly survivable measure, as was seen during Desert Storm, but it complicates accountability, security, and command and control. Maintaining forces in a quick response posture enhances survivability and crisis stability, if coupled with reliable early warning, command, control, and communication (C^3I), and a declared strategy and doctrine. Overall, hardening fixed facilities is the most stable because it makes accountability (for arms control), security, and command and control easier to manage.

Defensive Measures and Countermeasures. The combination of robust, highly effective active defenses, passive defenses, offensive forces, and arms control

regimes contribute to international security and stability. For example, the ability to hold-at-risk over an adversary's territory, its means to deliver WMD has a deterring effect. Active defense, such as an airborne or space-based laser, could ensure an adversary's missile or aircraft delivery means are shot down as soon as possible after launch. This presents the adversary's decisionmakers with the threat that their weapon effects will remain over their territory. The effects of an adversary's countermeasures to a particular type of active defense could be offset by the deployment of active defenses in depth (i.e., point, area, post–boost phase, and boost phase defense) or reliance upon the other legs of the security equation to minimize the incentive to use WMD. The overwhelming combination of all elements may even serve to deter the acquisition of WMD and the means to deliver them.

MIRVed Systems. Multiple independently targetable reentry vehicles (MIRVs) are not necessarily destabilizing. For example, if the nature of a nuclear force deployment includes the NCMs of high state of readiness and of survivable basing, such as mobility, as would have been the case had the MIRVed Peacekeeper weapon system been deployed in the rail garrison, then the synergy of these two elements would have increased crisis stability. The MIRVed system, on a high state of readiness would have enhanced deterrence, while its survivability in a mobile mode would have made it an impractical target to hold at risk, in other words, the price to attack would be too high.

Recallable Delivery Vehicles. Weapons systems that can be recalled (e.g., manned aircraft) offer a stabilizing feature to nuclear arsenals. Recallable delivery vehicles can be returned if changes in a situation dictate. If, for example, a nation

perceives an imminent threat to the survival of their nuclear arsenal, there is an enormous incentive to launch prior to the expected attack.

Component Miniaturization. Component miniaturization may serve as a NCM for many reasons. First, because of advanced technology involved, weapon systems can be designed safer. Second, miniaturization enhances the survivability of a nuclear deterrent force by stressing the defense capabilities of an adversary. Third, because of the improved quality, reliability, survivability, and expense in high technology weapons, a nuclear state would not need as many offensive weapons, thus contributing to arms limitation agreements. Fourth, on the defensive side, miniaturization enables a state to deploy more effective defensive systems, perhaps even non–nuclear tipped theater missile defenses, an extremely important NCM. Fifth, component miniaturization may facilitate the development of effective and transportable detection technology to thwart the smuggling of nuclear weapons by terrorists.

Stability via Political Measures. Proliferating nations can enhance the stability of nuclear forces through application of certain political measures. International agreements and open dialogue on military activities, intentions, and nuclear policies can reduce the potential for misinterpretation of a nation's intent and provide clearer insight into their employment doctrine.

Leadership Succession. In the event national command authority is decapitated or interrupted, a clear devolution of control can avert a scramble for control of the nuclear force. A series of alternate successors ensures that nuclear weapons are employed or recalled only at the discretion of individuals legally recognized by the state to carry out such action. Ideally, the authority to employ nuclear weapons will rest with the

head of state. The legal succession for nuclear command authority should mirror the succession for the head of state, or at a minimum, retain the same relationship between political and military leaders of the state. This unambiguous devolution also ensures that potential warring countries understand that nuclear release authority is vested in civilian leaders who remain accountable for their actions.

Awareness Programs. Awareness programs aim to increase understanding of the destructive power of nuclear weapons, risks inherent in nuclear operations, and weapons effects. Effective awareness programs must be tailored to suit the cultural and political dimensions of the subject nation. Such indoctrination should be offered at all levels of responsibility—from national leadership, to military commanders, to operators. At the national level, these programs ensure that national leaders have considered the effects of nuclear detonations prior to their decision to use them. At lower levels, awareness programs ensure that personnel are cognizant of the dangers of failing to adhere to other safety, security, and stability standards.

Hot-line. "Of the agreements concluded to date, perhaps the most meaningful have established improved communications links between heads of state."[158] The experience of the superpowers in the Cuban missile crisis in 1962 led to the establishment of a US-USSR hot-line agreement in 1964. Such agreements facilitate rapid communications and have the potential to reduce misunderstandings/uncertainty in time of increased tension or war.[159] Hot-line use is contingent upon the establishment of normal diplomatic channels. Another form of hot-line that can facilitate decreased tensions is a joint military communications link (JMCL). Used to link national military command centers, a JMCL supplements existing communications channels.

Regional Test Bans. The technology employed in nuclear weapons today is considered so standard that nations can be confident that a simple nuclear device will work without actually testing the design.[160] Reverse engineering of proven designs, computer simulations, and modeling can be combined to produce a nuclear weapon. Testing and evaluating weapons provides a means to increase the reliability and efficiency of a existing designs. A ban on nuclear weapons testing would, therefore, impede efforts to increase the capabilities of existing arsenals through technological innovations. If advancements in nuclear technology for a given region remain relatively small, a key incentive to enter into an arms race is removed.

Launch Notification. Nations should provide advance notification of all missile launches that originate from their sovereign territory. This reduces the potential for mischaracterizing the intent of missile launches.[161] Additionally, this is particularly critical when dealing with limited geographic regions where any launch provides a short response window.

Halt to Dangerous Military Activities. These measures increase the confidence level in survivability of nuclear forces and their C4I, and limit conventional activity that may lead to a nuclear response. Measures of this nature include prohibitions on depressed trajectory missile flights, flights of bombers within zones contiguous to potential adversaries, and stationing aircraft carriers or submarines with cruise missile capability in zones adjacent to national waters of any a possible adversary.[162] In addition, limiting deployments and use of conventional military force in certain geographic areas can defuse perceived threats.[163] The massive Warsaw Pact ground forces arrayed against NATO, for example, necessitated deployment of tactical nuclear weapons, occasionally in

forward areas that could have resulted in early *use or lose* decisions. An agreement between new nuclear states to avoid this Cold War folly could preclude this destabilizing situation.

Military Exercise Notification. Advance notification of military exercises by nuclear weapons nations can promote stability if they reduce the possibility that exercises could serve as a prelude to attack. Such a perception could lead to preparation for a nuclear response to ensure survival of a threatened state. Obviously, notifications could be destabilizing if a nation used them as a pretext to actual mobilization. However, this concern can be mitigated by requiring a longer interval between notification and the actual initiation of the exercise. This would make it difficult for a nation that desired to maintain the appearance of compliance to mobilize troops and influence events in a specific theater.[164]

Regional Deterrence Dialogue. A regional deterrence dialogue could facilitate an environment where parties are persuaded to negotiate and implement confidence-building agreements. Over the past 25 years, the former Soviet Union and the United States successfully negotiated a number of confidence-building measures addressing events that could have precipitated inadvertent nuclear war. While outside attempts to dictate political solutions to regional issues would be rebuffed, third party coordination and provision of monitors and technical experts in an advisory status could lead to regional confidence-building agreements. Regimes incorporating measures such as notification of missile tests, formation of joint military commissions, and no-attack agreements could directly support stability. These discussions can be facilitated by the provision of neutral sites, third-party monitors, and technical experts.

Renunciation of Launch Under Attack (LUA) Doctrine.[165] With a survivable force and strong C4I, a nation can withhold the decision to strike if confident that sufficient forces can be brought to bear on the adversary following an attack. With the few, unprotected forces likely to be found in new nuclear countries, the only option to save a vulnerable force is to launch under attack.[166] Directing a launch of nuclear weapons based solely upon a few minutes of warning sensor data "virtually invites tragic error."[167] From the time indications are received to the time a launch must be directed leaves little time for actual decision making. Moreover, the decision will be based on indicators of attack versus confirmation. The incentive, however, is for a country to launch a nuclear strike before their destruction by an enemy's forces. The most significant step adversaries can take under these circumstances is to codify their renunciation of LUA under the terms of a formal agreement, and undertake measures, such as those recommended above, to forestall the emergence of circumstances that would lead inexorably to measures such as LUA.

CHAPTER 6

Formulating Nuclear Control Regimes

> The proliferation problem is global, but we must tailor our approaches to specific regional contexts. The United States seeks to cap, reduce and, ultimately, eliminate the nuclear and missile capabilities of India and Pakistan. In the Middle East and elsewhere, we encourage regional arms control agreements that address the legitimate security concerns of all parties.[168]

This quote from the *National Security Strategy of Engagement and Enlargement* indicates the United States is resolved to turn back proliferation where possible. The steps outlined are to cap, then reduce, and finally eliminate nuclear weapons where proliferation has occurred. This paper suggests that implementing regimes composed of nuclear control measures to create safety, security, and stability could reduce both the nuclear capability and will to use nuclear weapons among new nuclear states. This is entirely congruent with the first two steps of US national strategy.

Convincing nuclear states such as India, Pakistan, and Israel to eliminate their nuclear arsenals is indeed a formidable task. Their present security concerns may not make this a viable option. In fact, their long term security interest may never make it an option. Nevertheless, without abandoning the longer-term goal of nonproliferation, much can be done to ensure that arsenals in new nuclear states are safe, secure, and stable. Establishing nuclear control regimes may not eliminate their arsenals in the near term, but it can establish a basis for future negotiation and, in the interim, reduce the risk of accidental nuclear detonation, unauthorized use, or even a regional nuclear conflict.

Figure 8 illustrates the desired impact of nuclear control measures (NCMs) using the Two-Tier Proliferation Model.

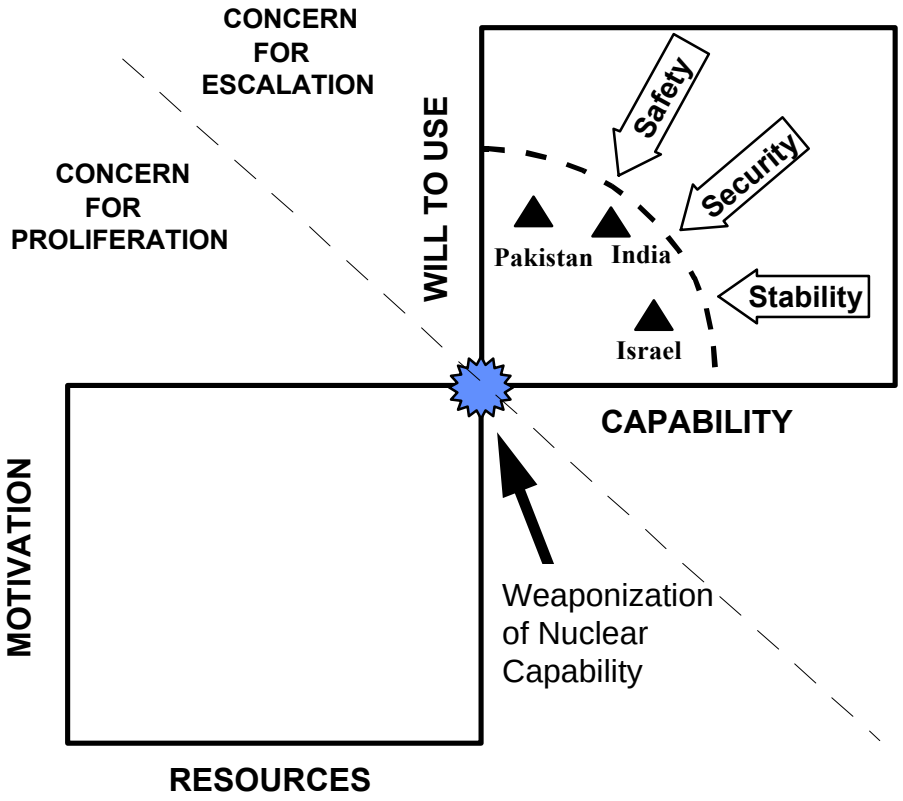

Figure 8: Reducing Capability and Will to Use

Reducing Capability

Capping and then reducing the overall capability of a country's nuclear arsenal can be achieved through implementation of appropriate safety, security, and stability NCMs. These measures can reduce or limit the total number of weapons fielded and provide greater stability in the manner in which they are deployed.

NCMs also reduce overall capability by limiting the manner in which weapons are deployed. For example, non-MIRVed missiles reduce the *attractiveness* of these weapons as targets and reduce the likelihood of entering into a counterforce arms race.

More Responsible Will to Use

Just as a country's nuclear capability can be influenced through implementation of NCMs, so too can their will to use nuclear weapons. A country with a stated *no first use* policy, coupled to a military doctrine and force structure that precludes preemptive or early use, is the lowest level in the spectrum of will to use. This is viewed as the most responsible level, which is the goal of safety, security, and stability NCMs.

Many of the NCMs serve to foster greater responsibility in the will to use. Hot-line communications between nuclear adversaries can reduce the likelihood of a misunderstanding or miscalculation, which may in turn cause a nuclear confrontation. Agreements on missile launch notification, military exercises and maneuvers, and separation of operational facilities from test facilities also reduce the potential for escalation of tensions. Ultimately, a country with a second-strike capability along with robust command and control systems can absorb an attack, fully assess the situation, and respond as required. NCMs can do much to reduce the possibility that national leaders will opt for nuclear war, but NCMs can also reduce the possibility that rogue factions or individuals from causing nuclear conflict.

The various safety and security NCMs prevent inadvertent or unauthorized use of nuclear weapons. Because of the destructive nature of nuclear weapons, inadvertent or unauthorized use can have dire consequences. If a nuclear detonation occurred over an

adversary's capital, pressure for retaliation would be tremendous, regardless of whether the incident was an accident or the result of unauthorized use. In short, each side has substantial interest in the other side's safety and security NCMs. Positive assurance that weapons will not be accidentally or inadvertently used reduces tension between two potential nuclear adversaries. A regime of NCMs, if implemented, has the potential to reduce the overall capability of nuclear arsenals and improve the responsibility involving the will to use them.

Why the US Should Help Proliferators

The dilemma for the United States is obvious. Does helping nations who have elected to pursue nuclear weapons undermine nonproliferation regimes? Will other nations contemplating nuclear capability view this as consent from the United States? If the US can seek opportunities to provide assistance in ways that do not increase these nations' nuclear capability, but improve their nuclear safety, security, and stability, the dilemma posed by these questions can be mitigated. The NCMs outlined in Chapter 5 illustrate the kinds of things the US can do, and should do, for proliferators. This by no means condones their activities; rather it is taking prudent steps to preclude a highly undesirable state of affairs—an unsafe, unsecure, and unstable nuclear environment.

Potential for Disaster. India's, Pakistan's, and Israel's strategic resources pale beside those of the United States. Despite tremendous concern for nuclear safety and security, the US has not been without its accidents. Fortunately, none of these has resulted in a nuclear yield or loss of nuclear weapons. One of the best examples of the robust safety mechanisms employed on US fielded weapons is illustrated by an accident at

a Titan II missile complex near Damascus, Arkansas. As a result of a socket wrench falling and bouncing into the missile during a maintenance operation, the fuel tanks ruptured and exploded, propelling the warhead through a reinforced concrete silo closure door. Safety features built into the weapon prevented both nuclear and non-nuclear detonations. A similar accident occurring to an emerging nuclear power's weapon system may have a different result. With limited resources, their safety and security provisions may not be as well developed. If such nations have already demonstrated a nuclear capability, it seems prudent to provide these nations with the technologies needed to prevent accidents of a catastrophic nature.

Precedent. The United States has, in the past, helped its allies with the development of nuclear weapons. The most obvious case is Great Britain, which developed its own arsenal to maintain international power and prestige. Unthwarted by initial discouragement from the United States, Great Britain continued with their nuclear program. The United States came to the conclusion that it was better for both countries if they became involved and allowed Great Britain access to the vast resources the United States had expended during the Manhattan Project.[169] Although the United States could not be expected to further a proliferator's nuclear capabilities as with Great Britain, offering expertise and technologies to improve safety, security, and stability does have precedent with at least one ally and possibly others.

Influence and Intelligence. Providing technical assistance and expertise to proliferators may allow access and insight into their nuclear program that might not otherwise occur. Numbers of weapons, weapon yield, range of delivery vehicles, and other information may remain a mystery unless assistance is provided to improve the

safety, security, and stability of their nuclear arsenals. US involvement in these issues provides opportunities to influence how these nations deploy and operate their nuclear weapons. Just as some US nuclear force deployment and operating practices and schemes were flawed, emerging nuclear powers may follow suite without recognizing the pitfalls and perils associated with them. For example, the decision to maintain a portion of the bomber force on airborne alert significantly increased the potential for an accident. Nuclear states may view this as a way to maintain survivability without understanding the safety issues involved. There are other examples which the US may want to influence force structure decisions to prevent unsafe, unsecure, or destabilizing initiatives. Offering assistance to prevent a nuclear accident, theft of a nuclear weapon, or regional nuclear conflict, may allow the US to influence how weapons are deployed or operated to maintain maximum regional and even global stability.

An Avenue of Negotiation. As the Clinton administration's national security strategy indicates, rolling back proliferation where possible is in the best interest of the US and the international community. The nonproliferation regime has been largely successful in preventing the spread of nuclear weapons, but not in all cases. A nuclear control regime, as presented in this paper, acknowledges that some countries will develop nuclear weapons despite collective nonproliferation efforts. Engaging in negotiation to improve safety, security, and stability of their nuclear arsenals in an attempt to reduce proliferators' overall capability and will to use can be viewed as the first step in rolling back proliferation. If a relationship can be established by first creating safety, security, and stability in a region, perhaps an opportunity to return the proliferators to non-nuclear status will emerge. Many argue that the US should not provide assistance to emerging

nuclear powers because it appears to dilute the US's stance on nonproliferation. Unfortunately, this stance has caused countries to maintain a level of ambiguity concerning their nuclear arsenals. Fearing political and economic sanctions, these countries have elected to deny the existence of their nuclear arsenals. Initiating a dialogue to turn back proliferation is unlikely if the proliferator refuses to admit they have nuclear weapons in the first place. However, if the US appears sincere in creating nuclear control regimes, opportunities may appear down the road to engage the larger strategy of reversing proliferation where it has occurred.

Nuclear Control Regimes

Constructing practical and effective nuclear control regimes must take into consideration the unique political and geostrategic circumstances of proliferated nations. Nuclear control measures, the building blocks of a nuclear control regime, are not uniformly applicable. Therefore, they must be tailored to meet the security interests of a particular nation or region. Those NCMs that are applicable form the basis for a bilateral nuclear control regime between India and Pakistan and a unilateral regime for Israel. For example, Israel does not currently need a hot-line because there are no other nuclear capable states in the region. This situation would change if a neighboring country acquired nuclear weapons. In addition, some measures may already exist, such as the hot-line between India and Pakistan, and can simply be incorporated when the nuclear control regime is negotiated. Also, after the 1990 Kashmir conflict, Pakistani and Indian military leaders agreed "to resume weekly meetings and to negotiate an advance notification agreement to cover military exercises."[170] In cases such as these, a bilateral or unilateral

regime may present ways to improve or build upon existing safety, security, and stability nuclear control measures.

Two regimes are discussed below. The first is a bilateral regime for India and Pakistan and the second is a unilateral regime for Israel. Each discussion presents an overview of the region's security interests, followed by an assessment of which NCMs apply to each situation, and finally, a review of how various nuclear control measures, as part of a nuclear control regime, will enhance the safety, security, and stability of Pakistan, India, and Israel's nuclear arsenals.

India and Pakistan: A Case for Bilateral Regime

Relations between India and Pakistan have been acrimonious since 1947, with most issues largely unresolved. Bilateral tensions between India and Pakistan may have reached critical proportions during a 1990 crisis, when danger of nuclear exchange may have existed.[171] As mentioned, Pakistan and India have already incorporated several nuclear control measures as a direct result of this conflict. But they need not stop there. Other measures, as discussed below, will further improve safety, security, and stability. Since there is already precedence for negotiating such measures, expanding to include an entire regime may be possible if each side is convinced it is in their best interest to do so.

Safety Measures. Due to their geographical propinquity and dense urban centers, both India and Pakistan are highly vulnerable to nuclear accidents, incidents, or detonations. A deliberate or accidental nuclear detonation in one country would inexorably contaminate the other.[172] Just as anticipated fallout patterns should reasonably be expected to act as a constraint upon the operational use of nuclear weapons, they

should also motivate India and Pakistan to embrace those safety measures that would reduce the potential for accidental hazard. Unlike the US and Soviet Union during the Cold War, Pakistan and India have a direct vested interest in the safety of each other's nuclear arsenals. A nuclear accident in Arkansas would have no impact on the Soviet Union, but a nuclear accident in Pakistan could cause tremendous loss of life in India if fallout reached populated areas. Jointly agreeing to seek outside technical and educational assistance in this area benefits both countries. By training individuals before they work with nuclear weapons, weapons systems, or critical components or perform nuclear-related duties, accidents caused by human error will be significantly reduced. The incorporation of IHE and FRP technology will further decrease the possibility of nuclear incidents or accidents. Proper safety and security measures during nuclear weapon or component transportation and storage would also contribute to a reduction in incident probability.

If an accident did occur, the impact could be sharply reduced by having properly trained accident response personnel, both military and civilian, present and prepared to respond. This applies equally to accidents at nuclear production sites, weapons storage areas, and power production facilities. All personnel assigned duties related to nuclear weapons should be trained to perform damage mitigation activities in response to nuclear accidents and incidents. Initial training should be accomplished upon assignment to a nuclear program; refresher training should be conducted periodically to maintain currency. Accident response contingency plans must include considerations for medical care for possible civilian casualties. Adequate medical care in India and Pakistan is limited and mostly available only in larger cities; outside assistance would be required to compensate

for shortfalls in doctors, facilities, and nuclear injury treatment training.[173] Sound education and training programs tailored to Indian and Pakistani needs can be provided by the United States or other third parties. Table 3 provides a summary of the safety NCMs that are needed by India and Pakistan, along with an assessment of whether they have them; and if they do, whether they are adequate. These assessments are based upon the analysis conducted in Chapter 4, along with comparing the proliferator's nuclear development program with early US experience. For example, the US did not have a personnel reliability program until 15 years into its nuclear weapons program.

Table 3: Safety Nuclear Control Measures for India and Pakistan

SAFETY MEASURES	Need	Have	Adequate
Safety Training	X	X	
Personnel Reliability	X	X	
Certification	X	X	
Unauthorized Use Analysis	X	?	
Accident Response	X	X	
Execution Message Procedures	X	X	
Strategic Nuclear Material Monitoring	X	X	
Insensitive High Explosives (IHE) & Fire Resistant Pits (FRP)	X		
Enhanced Nuclear Detonation Safety (ENDS) Systems	X		
Command Disabling Devices	X		
Armed and Disarmed Indicators	X		

Security Measures. For both India and Pakistan, security of nuclear weapons is of paramount concern. Both nations are highly susceptible to Islamic and other religious sect fundamentalism. In the extreme, religious zealotry could perceive nuclear weapons as the *end all* to prosecute a *jihad* or holy war. These fundamentalists may go to

extraordinary lengths to obtain and use nuclear weapons or share them with other Islamic nations or nations sensitive to their cause. Security measures for India's and Pakistan's nuclear arsenals must provide the greatest degree of protection.

Security NCMs such as enable codes, code custodians, functional separation of designers and operators, and establishment of no lone zones are no less than essential to prevent unauthorized use. To the maximum extent possible, split knowledge is needed at every level of operation. Command disablement capabilities to render weapons useless are particularly needed in the event a facility was attacked or overrun by large masses of people. Both countries must consider the security ramifications of large segments of the population turning against the government in an attempt to acquire nuclear weapons.

As a result of these concerns, particular care must be taken during storage and transportation of nuclear weapons. In a situation where nuclear weapons production, storage, and delivery assets are separated geographically, weapons will have to be transported, sometimes during the stress of a developing crisis. By using certain transportation measures, steps can be taken to improve the safe and secure transport of nuclear weapons and components. The United States, with its long experience in transport of nuclear weapons, can provide technical expertise and advice regarding the safe and secure transport of these weapons.

The secure transportation of nuclear weapons can be accomplished by two means, ground transportation and air transportation. In either case, security will be augmented by keeping "movement of nuclear weapons to a minimum consistent with operational requirements."[174] Ground movement of nuclear weapons should be by the safest, most secure routes, while air transport should be avoided altogether to preclude the greater

hazards associated with flying. Nuclear weapons and components are vulnerable to theft or sabotage during transportation. Equipment used for the transport of nuclear warheads should be certified and equipment operators should be properly trained in all facets of nuclear weapons movement. Security provisions for ground transport should include establishing security zones, limited access, and two-man policies. Moreover, movement of nuclear weapons should be exercised during peacetime using simulated warheads to allow for improvement in procedures. Table 4 provides a summary of the NCMs that should be incorporated in a nuclear control regime for India and Pakistan. It should not be surprising that all of the security NCMs are recommended for these countries.

Table 4: Security Nuclear Control Measures for India and Pakistan

SECURITY MEASURES	Need	Have	Adequate
Enable Codes	X		
Code Custodians	X		
Functional Separation	X	X	
No Lone Zones	X		
Reliable and Survivable C4 Systems	X	X	
Physical Separation of Warheads/Delivery Systems	X	X	X
Impenetrable/Secure Storage	X	X	
Secure Transportation Methods	X	X	

Stability Measures. The need for stability measures is apparent due to recent events on the subcontinent. In late 1986**,** India staged the largest military exercise in modern Indian history by positioning its military forces in the desert area of Rajasthan, roughly a hundred miles from the Pakistan border—an ideal location from which to attack the Pakistani state of Sind and subsequently sever Pakistan in half.[175] Some have suggested that India may have integrated special weapons, including tactical nuclear bombs, into these troop field maneuvers. In response, Pakistan moved armored units to

the border and asserted willingness to use the bomb "if driven to the wall."[176] This scenario was repeated in 1990 as uprisings in Kashmir led to another Indian deployment to Rajasthan. Pakistan again moved armored units near the border—and may have assembled nuclear bombs in preparation for a nuclear response.[177]

This posturing between India and Pakistan provides a clear example of Indian conventional military might and Pakistan's threatened nuclear response. While the Indian and Pakistani governments have since found it prudent to conduct weekly talks and provide advance notice of anticipated exercises to preclude a repeat of these problems, other steps to avoid dangerous military activities can immeasurably aid stability.

The establishment of and adherence to a *red line* that proscribes military operations within areas where intent could be readily misinterpreted would placate Pakistani fears of attack. Indian military exercises conducted near vulnerable Pakistani borders would certainly increase tensions unnecessarily. Likewise, Pakistan must be willing to give up possible military exercises near areas considered sensitive by India, such as exercises that could be perceived as a threat to Kashmir.

Perhaps the most important stability measure to consider in a bilateral context is regional deterrence dialogue, since it is most likely to be the foundation for many other measures. The dialogue between India and Pakistan has already resulted in the codification of exchanges of exercise information and establishment of a hot-line. A 1988 agreement preventing strikes against each other's nuclear facilities was ratified in 1992; lists of the applicable installations were subsequently exchanged.[178]

Continuing these discussions is the region's best hope for the introduction of mutually beneficial nuclear control regimes. Weekly meetings between the two nation's

military leaders were agreed upon in December 1990 and trilateral discussions, albeit unofficial, have been arranged by American think tanks to discuss the Kashmir problem.[179] Robert L. Gallucci, formerly the Assistant Secretary of State for Political and Military Affairs, outlined US policy regarding negotiations, stating "we also are attempting to promote confidence-building measures (CBMs) between India and Pakistan. We have had bilateral discussions with both countries aimed specifically at CBMs in the nuclear area. . . ."[180] While Pakistan has taken the lead in suggesting proposals,[181] India has held two sets of nonproliferation talks with the US. While no major breakthroughs occurred, these negotiations offer hope of expanded cooperation that could include a nuclear control regime of the NCMs listed in Table 5.

Table 5: Stability Nuclear Control Measures for India and Pakistan

STABILITY MEASURES	Need	Have	Adequate
Intelligence on Strategic Indicators	X	X	
Separate Test and Operational Facilities	X	X	X
Graduated Response to Crisis	X	X	
Post Attack Assessment	X		
Pursue Sovereign Basing Only	X		
Reduced Alert Status	X	X	
Early Warning Systems	X	X	
Survivability	X	X	
Discourage Defensive Measures/Countermeasures	X		
Discourage MIRVed Systems	X		
Recallable Delivery Vehicles	X	X	
Discourage Component Miniaturization	X		
Leadership Succession	X	X	
Awareness Programs	X	X	
Hot-line	X	X	
Regional Test Bans	X		
Launch Notification	X		
Halt to Dangerous Military Activities	X	X	
Military Exercise Notification	X	X	
Regional Nuclear Deterrence Dialogue	X		
Renunciation of Launch Under Attack (LUA)	X		

Israel: A Case for Unilateral Regime

As indicated earlier, nuclear control regimes must be tailored to meet the national security interests of a particular nation or region. This section will examine the case of Israel. Keeping in mind the incentives that drove Israel to develop its own nuclear capability, a control regime is proposed that is consistent both with Israel's security interests and a maximum level of safety, security, and stability. As was done for Pakistan and India, Israel's regional security interests will be covered and then a discussion on how various nuclear control measures can be incorporated into a nuclear control regime to enhance the safety, security, and stability of Israel's arsenal.

Israel developed a nuclear capability as the guarantor of its survival. As such, Israel will exercise its nuclear option only when national survival is at stake. Under this premise, nuclear deterrence or retaliation for limited war objectives would be inappropriate. Therefore, a unilateral nuclear control regime designed for Israel should seek the maximum level of safety, security, and stability consistent with its likely use of nuclear weapons for national survival. Any control regime must also recognize that Israel's adversaries may eventually obtain a nuclear capability. When this happens, the nature and focus of the control regimes will shift to bilateral or multilateral concerns.

Safety Measures. Safety programs like PRP, accident response capabilities, equipment and procedures certification, and well-defined personnel training programs take on greater significance due to the fact that Israel's weapons must be maintained at a relatively high state of overall readiness. Although it is not proposed that Israel adopt a *hair-trigger* alert posture, their geographic vulnerability and short response times dictate a

need for weapons configured for more rapid employment than states with larger geographic areas, which could trade time for crisis resolution. Mated weapons systems afford greater access and therefore greater opportunity for misuse. Under these conditions, only personnel of the highest reliability and competence should be granted access. Additionally, accident response capabilities must be immediately available. Many of the incidents the US has experienced over the past 50 years have resulted in failures in the mated weapon system, not the nuclear warhead. Enhanced safety measures such as PRP and certification of equipment help balance the tradeoff of lower marginal security (mated weapon systems) and survivability. PRP ensures only reliable individuals have access to nuclear weapons and components to minimize the possibility of a conspirator to perpetrate unsafe or unauthorized activities. Equipment certification ensures maximum safety standards are applied to the entire weapon system. Personnel training, particularly compliance with execution message procedures, give Israeli decision makers the confidence that orders will be transmitted and carried out even under severe time constraints. This reduces the incentive to strike early in a crisis situation.

Perhaps the most significant contribution the US can make to the safety of an Israeli arsenal is through the transfer of specific technologies. Just as the US gave priority to military requirements over safety improvements early in the nuclear program,[182] it can reasonably be assumed that Israel has done likewise. Now that the US has developed safety technology such as IHE and ENDS, making them available would help Israel enter into a new phase of safety modernization that they might otherwise neglect until more economically feasible. As was recommended for India and Pakistan, all of the safety NCMs are recommended for Israel and are reflected in Table 6.

Table 6: Safety Nuclear Control Measures for Israel

SAFETY MEASURES	Need	Have	Adequate
Safety Training	X	X	X
Personnel Reliability	X	X	X
Certification	X	X	X
Unauthorized Use Analysis	X	?	
Accident Response	X	X	
Execution Message Procedures	X	X	X
Strategic Nuclear Material Monitoring	X	X	X
Insensitive High Explosives (IHE) & Fire Resistant Pits (FRP)	X		
Enhanced Nuclear Detonation Safety (ENDS) Systems	X		
Command Disabling Devices	X		
Armed and Disarmed Indicators	X		

Security Measures. As previously stated, Israel does not appear to use the complex mechanisms of *electronic locks* and *double keys* used in the US. The security of their arsenal would improve dramatically if they adopted an enable code system like that of the US. The overall integrity of the Israeli system would also benefit if only the individual authorized to initiate nuclear warfare possessed these enable codes. The military's responsibility to maintain the weapons and their control by the Prime Minister may lack a clear dividing line. If so, giving the Prime Minister sole responsibility for the enable codes would resolve this problem.

Under most circumstances, the separation of warheads from delivery systems provides added security by denying simultaneous access to both. However, security procedures must also ensure that the weapons are available for use when needed by competent authorities. The 1973 Yom Kipper War provided a glimpse of Israel's lack of strategic depth and speed at which an adversary can attack into rear areas. Acquisition of modern aircraft and missiles by the Arab countries compounds the strategic vulnerability

of the Israeli military. The tradeoff between survivability and security is, therefore, of critical importance. The added security gained through separation of weapons and delivery systems invites preemptive attack against Israel's nuclear storage facilities. A regime requiring Israel to place its nuclear weapons in this type of configuration is probably inappropriate. Table 7 summarizes the security NCMs for Israel.

Table 7: Security Nuclear Control Measures for Israel

SECURITY MEASURES	Need	Have	Adequate
Enable Codes	X		
Code Custodians	X		
Functional Separation	X	X	X
No Lone Zones	X	X	X
Reliable and Survivable C4 Systems	X	X	
Physical Separation of Warheads/Delivery Systems			
Impenetrable/Secure Storage	X	X	
Secure Transportation Methods	X	X	

Stability Measures. Because of the unilateral nature of Israel's possession of nuclear weapons, stability measures are less critical than they are for India and Pakistan. Three measures, however, stand out in terms of importance: survivability, recallability, and a halt to dangerous military activities.

In terms of rapid response and mobility, alert aircraft represent a highly survivable system. They can be deployed to rear areas, re-deployed, launched, and recalled as the tactical situation dictates. The main problem with aircraft is their reliance on and proximity to airfields that may be vulnerable to air strikes. The NCMs recommended assume that Israel retains a qualitative edge in air superiority. Drawing from the US ground-launched cruise missile experience, mobile missile systems like the Jericho II are slow moving and require large security forces for protection against sabotage during

convoy. They are, therefore, easy to identify and track by clandestine ground observers. Once deployed to remote launch locations, command, control, and communications are also difficult to maintain, a condition that limits effectiveness. The Jericho III missile requires permanent launch facilities hardened against both conventional and nuclear attack for survivability. This type of deployment puts pressure on potential adversaries to develop counterforce weaponry.

The deployment of Jericho II and recent development of the Jericho III missile with its 4,800 to 7250 km range are destabilizing for other reasons. The range of the latter exceeds Israeli requirements for a regional deterrent weapon. Moreover, neither of these delivery platforms are recallable. Political brinkmanship coupled with the propensity for disputes to escalate into violence and for the intent of adversaries to be misinterpreted support use of recallable delivery systems. The preponderance of nuclear capable aircraft such as the F-15, F-16, F-4, and Kfir are suitable to carry Israel's arsenal.

Military exercises and deployments of conventional forces in potentially hostile regions can lead to disastrous consequences. A halt to dangerous military activities reduces the likelihood that conventional conflict will occur or escalate into a nuclear response. The enormous conventional military forces facing each other in the Middle East constitute fertile ground for misinterpreting military activities and maneuvers. One only has to go back to the 1967 war to examine such a case. Egyptian forces initially deployed to the Sinai to deter Israel. Israel, seeing a clear threat to its security, chose to strike preemptively. Mutually agreed upon exclusion zones and restrictions to maneuver in strategically important areas would help prevent this kind of response. Also, during peacetime, an agreement between Israel and the Arab states regarding notification of

exercises would significantly defuse sensitivity over movement of forces and recall of reserves. Nations in the Middle East have a well pronounced sensitivity to these activities due to the preferred strategy of surprise attack and preemptive retaliation.[183]

There are, however, several stability measures that would be inappropriate for Israel because there is no regional nuclear adversary. Open-source documentation points to Israel as the sole possessor of nuclear weapons in the Middle East. For this reason, Israel has no incentive to commit significant resources into measures that enhance their ability to confront a nuclear adversary. Post attack assessment procedures, early warning systems, and hot-line agreements, while stabilizing in a region with nuclear adversaries, do little in a region currently devoid of such a threat. In the case of early warning systems, a false alarm or technical error is likely to set off an accelerated process of nuclear posturing and responses. This generic problem of misperception is accentuated by the prevalence of extremist assumptions concerning the intentions of the enemy. The US and Russia alleviated this problem through deployment of highly sophisticated and redundant systems.[184] Neither Israel nor its Arab neighbors are likely to have the resources to field similarly sophisticated systems.

Regional test bans apply primarily to countries in a bilateral relationship of evaluating and modernizing existing nuclear capabilities. If Israel's Arab neighbors seek to develop nuclear capability, they will not necessarily require the testing of a device. Modeling, simulations, and reverse engineering of proven designs can provide reliable data for development. Therefore, a regional test ban would do little in terms of stability or reducing the propensity to escalate an arms race.

Finally, regional nuclear deterrence dialogue and renunciation of LUA do not apply to the case of Israel. Both of these measures require direct negotiations with a nuclear-armed adversary. Of course, if Israel were to link nuclear retaliation to a chemical attack, then renunciation of LUA and deterrence dialogue would take on new significance. Table 8 lists all of the stability NCMs as they apply to Israel.

Table 8: Stability Nuclear Control Measures for Israel

STABILITY MEASURES	Need	Have	Adequate
Intelligence on Strategic Indicators	X	X	X
Separate Test and Operational Facilities	X	X	X
Graduated Response to Crisis	X	X	X
Post Attack Assessment			
Pursue Sovereign Basing Only	X		
Reduced Alert Status	X		
Early Warning Systems	X	X	
Survivability	X	X	
Discourage Defensive Measures/Countermeasures			
Discourage MIRVed Systems	X		
Recallable Delivery Vehicles	X	X	
Discourage Component Miniaturization	X		
Leadership Succession	X	X	X
Awareness Programs	X	X	X
Hot-line			
Regional Test Bans			
Launch Notification			
Halt to Dangerous Military Activities			
Military Exercise Notification	X		
Regional Nuclear Deterrence Dialogue			
Renunciation of Launch Under Attack (LUA)			

Conclusion

India, Pakistan, and Israel are willing to disregard international pressure to develop nuclear weapons. For them, no cost is too high because of the perceived benefits of a nuclear arsenal and the associated security guarantees. It is unlikely that these countries will be the last to proliferate. Others will follow and unless the international community is

willing to remove those weapons, the US needs a course of action to address the problems associated with countries emerging as nuclear powers.

The process of developing and implementing nuclear control regimes does exactly that. Capping and reducing nuclear arsenals and the associated will to use them can be brought about by carefully crafting nuclear control measures to enhance safety, security, and stability. Eliminating nuclear arsenals altogether may or may not be achievable, but preventing escalation of capabilities and the will to use nuclear weapons is a logical first step.

The security risks associated with military operations in a region with nuclear weapons is obvious. Although the US must possess capabilities to deter, prevent, or defend against their use, it is far better to influence those capabilities today, rather than confront their manifold problems tomorrow. Taking positive steps to cap and perhaps to reduce emerging nuclear powers' arsenals will go a long way toward enhancing safety, security, and stability in a proliferated world.

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